APPENDIX A:
Public Comments

ID	Date	Comment
01	**February 1, 2018** Steffen Janikula	As Trails Coordinator with the City of Great Falls-Park & Recreation Department I would like to stress the need for safe bike travel within the City as well as connectors to the River's Edge Trail(RET). The RET is a main corridor for bike/walk travel. Any on-street upgrades would be appreciated and fill a need voiced by residents in a Master Plan Survey conducted in 2016 that found that walking and biking trails are the "Highest priority for facilities, based on the Priority Investment Rating."
02	**February 1, 2018** Anders Blewett	Dear Long Range Planners, I have the following suggestions to share with you regarding the non-motorized portion of the long range transportation plan for Great Falls. I would rank them in the following order. 1. I would encourage you to add a bike route along the following route. This will further extend the existing 9th Ave. Southwest Bike Route and connect to some good road biking on 10th Ave SW onto Central Ave. West. 2. I would suggest exploring the possibility of adding a shared use path near the airport on the west side of I-15. Given that Andrew Finch is involved, I assume this is something you have already looked at but I just wanted to make sure this issue is addressed. This would be in addition to the shared use path on the East Side of I-15 that you are proposing which is very necessary. I agree that creating the shared use path on the East side will probably be easier. I have pointed out several possible routes below. 3. I would suggest exploring the possibility of adding a bike lane in the downtown area on 1st Ave. North where it is three lanes (between Park Ave and 9th Street)? I assume this would require eliminating one lane of traffic but this would prevent it from feeling like such a freeway. I also doubt this road really needs three lanes given the amount of traffic on it. Thank you for your attention. Please feel free to contact me if you have any questions. Sincerely yours, Anders Blewett
03	**February 8, 2018** Charles Nardinger	I live south of the hospital in G Falls and I would like to comment on Tenth Ave South here in G Falls. Every time I leave my condo to go anywhere in G Falls I get stalled in the traffic on Tenth Ave South. We need a bypass South of G Falls beginning at the Stockett turn off and the top of Gore Hill. This should have been done 30 years ago and it just keeps getting worse. It is now so costly that I don't know if it can be done, but it is only going to get worse. Thanks for giving me an opportunity to comment. Chuck Nardinger
04	**February 19, 2018** Chis Ward	Map comment feature is kind of clunky. I didn't see how to add comments in a location where there isn't already a project shown, and can't add comments on non motorized map. River Drive North should have separated sidepaths in the plan. Especially on the south side, and especially from 19th St to 25th St. North side path would be nice but more recreational in purpose than the south side which would serve a transportation need. Due to the elevation difference and lack of street connections rivers edge trail is not an alternative to River Drive for most bike trips. Bike lanes don't make sense on river drive due to higher volumes and speeds. This needs to be a separated bike facility. Bike lanes on 38th are not necessary. The sidepath is in place from 10th Ave N. to River Drive. Extend the separated sidepath from where it ends now to Fairway Drive. This is especially needed to prevent vehicles from parking on the path and also to facilitate snow removal. Plan for a good path crossing at 10th Ave N. for future 10th ave N sidepath. From Fairway to 10th Ave S, 36th St is a preferable bike route to 38th. 36th should be enhanced as a bicycle boulevard with features to discourage motor vehicle traffic other than local access. Improve geometry of path crossing at signal at 38th and River Drive N. It is too narrow which makes snow removal a problem. Reconstruct to provide separation buffer between curb and path on north side. Wider cross walk, wider curb ramps, and add leading pedestrian interval to signal. Recent development east of 46th St S has been required to dedicate right of way for a future extension of Central Avenue. Consider this Central Avenue extension as part of the street network, and where north south connection at 50th/52nd street should be. Reconstruct sidepath on west side of River Drive across from

		Milwaukee Depot to provide a landscape buffer (get rid of curb walk) and build a gradual loop ramp from northbound rivers edge trail up to Weissman bridge. Nonmotorized separated path connection to Marketplace should be the top priority (BNRR tunnel) to connect 18th Ave SW to Marketplace. Restore adequate storage length for both northbound lanes on Fox Farm road at 10th Ave S signal. The little island interferes with queuing at the signal and the overhead lane signs don't make sense with the island there. Clara Park path is a good idea to establish a nonmotorized corridor to new east end retail development. Buffered bikeway conversion doesn't make sense on north south couplets. Adjacent north south streets are fine bike routes. Show 12th Ave N from 15th St to the caboose trailhead as a bike lane route. River Drive should eventually have a tunnel to trail at caboose trailhead. Get rid of the sidepath project from 15th St. down to the trail (15th St N Connector Trail). The 15th and River Drive intersection is already bad and not the right place to encourage more pedestrian use. There is heavy pedestrian and bike use of 12th ave N to access the trail. Needs to be formalized. Do some bike ped traffic counts on 12th Ave N and on 15th St between 8th ave N and 12th ave N. This is probably the most utilized nonmotorized corridor in the street system. This is a key access point to the trail system. Need a bi directional separated green cycle track and separate sidewalk between 9th Alley N and 12th Ave N. It is not reasonable to expect southbound bikes and peds to cross over to 14th St. if their destinations are on 15th or to the east. Make better use of the wide street right of way.
05	**March 3, 2018** Chis Ward	The separated shared use path on 38th needs to be extended to Fairway Drive, replacing the couple hundred foot stretch that is on the shoulder of the road and then a 5' curbwalk, with a 10' separated sidepath as exists the rest of the way to NE Bypass. A full width path for this short distance would allow the plow to continue to Fairway and leave space for snow storage. This is a vital year round connection to the residential areas via 36th and 38th streets both of which are on the nonmotorized network. Here are a couple photos showing the perfectly cleared sidepath to the north and impassible sidewalk with a snow berm blocking it.
06	**March 19, 2018** Shyla Patera	My name is Shyla Patera. I am submitting comments on behalf of North Central Independent Living Services,Inc. and as a resident of the City on the minor update to the Long Range Transportation Plan. As a person with a disability and a resident of Great Falls, Montana, I ask you to incorporate the City of Great Falls' Americans with Disabilities Act public right of way and transition plan into the minor update of the Long Range Transportation Plan update. This ADA public right away is ambitious and incorporates many aspects of accessibility in design and public funding. As a non-motorized user and a public transportation advocate,rider and user of services, I particularly ask that the City of Great Falls focus on ADA curb cuts and ramps, accessible alleyways, as well as making our sidewalks contiguous. We need to ensure that all traffic signals and mobility devices meet and exceed timing standards so that individuals and pedestrians can make it through cross walks. I also believe that we need to acknowledge that many pedestrians and wheelchair users must walk or ride along the streets in many residential areas of Great Falls. Often times in our neighborhood streets, there are not wide shoulders or safe areas along many streets to accommodate wheelchair traffic safely. I understand that urban road systems and connectors often have a bike path and wider shoulders on their streets, but even this can be a problem if vehicles are parked in the parking spot and a mobile wheelchair user has to go around a parked vehicle. For those who drive vehicles, we need more community enforcement of our ADA disability parking standards and fines. This is just a suggestion for employment and volunteer opportunities for many Great Falls residents with disabilities, maybe, we can train citizen volunteers with disabilities on community enforcement of standards just as GFPD has done. Our community needs to ensure that access aisles for parking are wide enough to accommodate cars, vans, chairs ,both power and manual, and that they are on the most accessible pathways to community businesses, recreational spaces, municipal buildings and more. We need community discussion on snow removal, accessible way finding and signage, sidewalk pavement preservation and more. As a homeowner, I often struggle with rounded curbs when exiting a car or vehicle . I believe that we as a

		community really need sidewalk pavement preservation and a check of our ordinances for homeowners and where property lines truly begin and end on the public right of way. Finally, as a public transit user, I thank the City of Great Falls for its support of Great Falls Transit . The support that the MPO has given GFT has played a vital role in keeping our transit system running and operating in Great Falls. Thank you for allowing me to submit comments regarding the non-motorized portion of the Long Range Transportation Plan minor update. Shyla Patera

Category	Initial Comment	Comment	Comment Date	Net Like	Like	Dislike	
Recommended for Funding Points	SR-1: Intersection should be periodically checked for signal Warrants as development and projects occur around the community.	I Agree but extend the study to include 38th street to 3rd ave So. Present traffic is 13000 cars per day with a peak 1000 cars per hour. an estimated 130 students are picked up and unloaded from school principally on 38th street. The street needs to be widened for parking. The school was built when 38th-st dead ended at Central Ave. So the entrance to the school faces 38th St. which is the most convent place to pickuo and discharge students.	2/5/2018 16:16	2	2	0	
Recommended for Funding Points	SR-1: Intersection should be periodically checked for signal Warrants as development and projects occur around the community.	Yes but please check travel time impacts vs. 36th street. Already too much through traffic on 36th as a way to avoid school congestion and signals. 36th should be reconfigured as a neighborhood greenway. Consider a diagonal diverter at 5th Ave S and 36th for example, other measures to reduce through traffic that should be using 38th. Consider prohibiting parking on 38th (not much anyway) and restriping with a center turn lane. Bike lanes on 38th are not necessary as 36th is a better bike route and can be enhanced. Need to look at different entrance/drop off arrangements at Lewis and Clark Elementary to reduce congestion on 38th.	2/19/2018 16:00	2	2	0	
Illustrative Projects	7: Reconstruct to collector street standards.	Park and 8th Ave N intersection is confusing. Roundabout would be good.	2/19/2018 15:41				
Illustrative Projects	17: Construct 44th Avenue NE. New route should be constructed to a minor arterial standard with limited access control.	This is a great opportunity. Please emphasize this corridor in planning. Needs to be a real divided arterial with limited street connections into the neighborhood. Plan to extend it to I-15 and build a full interchange to replace Emerson Junction.	2/19/2018 15:45				
Illustrative Projects	17: Construct 44th Avenue NE. New route should be constructed to a minor arterial standard with limited access control.	I Agree	2/19/2018 15:52				
Recommended for Funding	MSN-1: Reconstruct facility along its existing alignment to a minimum three-lane principal arterial standard.	Start early property acquisition between 19th St and 25th street. Shift the road away from the cliff. Road needs more room in here and private access and parking in public right of way needs to be controlled. 3 lane might work for now but set aside space so lanes can be added in future.	2/19/2018 15:26				
Recommended for Funding	SR-4: It is recommended that this corridor and corresponding intersections undergo re-striping and intersection modifications.	1st Ave N railroad underpass only needs to be one track. Remove and rebuild as one track wide. Replace the vertical walls with slopes. Need a safer more welcoming sidewalk connection.	2/19/2018 15:39				
Recommended for Funding	SR-6: Pavement preservation activities including mill, overlay, seal and cover, and striping.	Look at a better north end for 26th St. At a minimum eliminate parking on s side of 8th Ave n for better visibility at stop sign. Or make 26th one way southbound from 8th to 7th Ave n, and make 7th Ave N one way westbound from 26th to 25th, with two way traffic on 25th starting at 7th Ave n. Free right from 7th onto 25th.	2/19/2018 15:30				

ID	Date	Comment
01	**April 11, 2018** Susan Hillstrom	April 11, 2018 Comments at Neighborhood Council #2 Meeting Susan Hillstrom 607 3rd Ave SW There continues to be increasing traffic speed by increasing numbers of drivers who violate speed limits on 6th Street, which is resulting in the degradation of quality of life in west side residential neighborhoods, and for other drivers who use this route. It is a safety hazard for pedestrians crossing 6th Street, as speeding vehicles make it more difficult to cross all four lanes of traffic, because most drivers don't slow down for pedestrians in crosswalks. It is a safety hazard for pedestrians using the sidewalk or waiting for a bus, because the sidewalk is at the curb and is also fairly narrow. It has resulted in an increase in noise pollution from vehicles that are speeding or racing south from Central toward the railroad underpass. Large trucks are now using engine compression brakes on Central Avenue and on 6th Street. There is ongoing development along 3rd St NW, River Drive, Bay Drive, and at 10th Avenue and Fox Farm Road. Increased development equals increasing traffic. If the city continues to ignore what's happening on 6th Street, an opportunity to improve the city, the quality of life for its residents, and the value of the unique characteristics of the west side historic neighborhoods will be lost. I feel strongly that the city has abandoned the west side neighborhoods. Visible traffic and neighborhood patrols have disappeared. We live in close proximity to the Missouri River corridor and historic downtown area. West side residents could benefit greatly from the amenities the river corridor and downtown have to offer, if only it was safe and also enjoyable to walk or ride a bicycle to nearby attractions like the River's Edge Trail, Water Park, Farmer's Market, Gibson Park and band shell for concerts, Civic Center, Library, or downtown shops. Potential Solutions: 1) Reference the attached map: increased speed limit signage is needed; it's lacking in several places. 2) Increase enforcement. 3) Install speed monitoring signs. 4) Paint crosswalks. 5) Add "Stop for Pedestrians in Crosswalks" signs. 6) Decrease the speed limit from 40 to 35 mph going south past American Avenue and going north from the Sun River to the railroad underpass. (It's only 0.7 mile). Since I've been visiting with my neighbors about this issue, other ideas have been mentioned. Please see the attached page with their names and addresses.
02	**May 9, 2018** Susan Hillstrom	May 9, 2018 Susan Hillstrom, 607 3rd Ave SW Comments at Neighborhood Council #2 Meeting I visited with some of my neighbors and shared my written comments from April 11 on traffic conditions on 6th Street SW. I have collected six signatures of my neighbors who agree that there is a problem: Our quality of life, safety, health, and transportation alternatives are impacted by the bad driving behavior of drivers of all types of vehicles who regularly disregard the 30

		mph speed limit and exceed it by 10 mph or more, knowing that the speed limit is 40 mph on the other side of the railroad overpass and also by north bound drivers still going 40 mph toward Central Avenue W. There is also a growing segment of south bound drivers who wantonly ignore the 30 mph speed limit and derive satisfaction from the challenge and rapid acceleration approaching speeds of upwards of 50 to 60 mph (some of my neighbors claim to witness speeds of 80 mph) by the time they reach the railroad overpass. We all hear them from inside our homes, at various times during the day. I would estimate that this occurs three or four times each day, and is worse on the weekend beginning Friday through Sunday night. There are several plans that articulate transportation policies, visions, goals, and objectives to improve the quality of life of citizens and the livability of our community. These plans include: Great Falls Growth Policy, the Missouri River Urban Corridor Plan, the Downtown Access, Circulation and Streetscape Plan, the Downtown Master Plan and the Great Falls Long Range Transportation Plan (LRTP). Each of these plans contain goals and objectives to improve, encourage, promote, "increase mobility and access of citizens to transportation alternatives throughout the city, support efforts and programs that seek to improve school crossings, pedestrian access and the safety of those enroute to and from schools, enhance pubic access to community services and programs such as the library, Mansfield Center, and other civic facilities and events, create a built environment that promotes easy access to safe walking, biking and other opportunities for physical activity" (Growth Policy 2013). Yes, 6th Street SW is an arterial route, but it is a residential area between Central and 4th Avenue S, and the bad driving behavior needs to be improved for the safety and health of our citizens and livability of our community. My comments from April 11 include some solutions and my neighbors mentioned other ideas as well, such as painting the speed limit on the pavement where drivers are focused (the only 30 mph speed limit sign south of Central at 3rd Ave is missing the "S"). Why not route Airport traffic on Central Avenue west to I-15, instead of south on 6th Street to 10th Avenue south, an intersection already experiencing a failing level of service because of the volume of traffic? A radar monitoring sign would pay for itself with the money the city would make if enforcement of the speed limit took place. My neighbor with four young children drives his son to and from West Elementary School because it's not safe for him to walk or ride a bicycle; they load their bicycles in their vehicle to go ride where it's safe (the River's Edge Trail is a quarter mile away, but across 6th Street SW). The Long Range Transportation Plan describes traffic calming measures and "methods used to reduce vehicle speeds, improve safety, and enhance the quality of life", many that I and my neighbors have mentioned. I feel that I must begin the process to implement a "traffic calming program" as outlined in the LRTP: Phase I, Step 1: Problem Identification and Investigation, by requesting an Investigation Request Form to be completed and sent to the Public Works Department. I'm willing to help.
03	**May 18, 2018** Susan Hillstrom	May 18, 2018 Susan Hillstrom 607 3rd Ave SW, Great Falls, MT 59404 To: Scott Randall Re: Great Falls Area Long Range Transportation Plan – 2018 Update Thank you for your effort and excellent work on the Great Area Long Range Transportation Plan (LRTP). It holds a great vision for the Great Falls area. I am particularly impressed with the depth of the LRTP when it comes to addressing all modes of transportation including non-motorized alternatives. It's very encouraging that my community values are actually expressed and addressed in many sections of this plan as articulated in many other plans for Great Falls (Growth Policy, Downtown Master Plan, etc.)

My west-side neighborhood is adjacent to the "secondary impact zone" identified in the Missouri River Urban Corridor Plan, within walking distance of downtown, but the 6th Street SW arterial between Central Ave W and 4th Ave SW has sliced this historic neighborhood down the middle and created a raceway for disrespectful drivers. Our connectivity to the river corridor and downtown has been lost, our neighborhood has become separated from community facilities. We suffer from noise pollution, and decreased property values. My Neighborhood Council #2 tells me that they have tried to get the city to do something about the traffic conditions here for years. I have collected signatures from neighbors who agree that traffic conditions on 6th Street SW need to be improved.

I attended the open house meeting on May 10. Thank you for the markings that you made on the map to indicate the areas with issues and for listening to my concerns:

- increasing speeding on 6th Street SW between Central Ave W and American Way,
- lack of speed limit signing between Central and 4th Ave SW,
- lack of safe crossings for pedestrians and other non-motorized users (failure of drivers to yield),
- routing airport traffic from Central Ave W to south on 6th Street SW to an already dysfunctional intersection at 10th Ave SW.

I documented locations of current 30 mph Speed Limit signs and identified that in the area of concern there is only one sign at 3rd Ave SW on the west side of the street, none on the east side of the street.

New development is increasing along 3rd Street NW and in the 6th Street SW corridor; a PUD (Planned Unit Development) is underway near the golf course on American Way: 3 – 12 unit, 2 bedroom, 2 bath, apartment buildings, that's the equivalent of 36 homes!

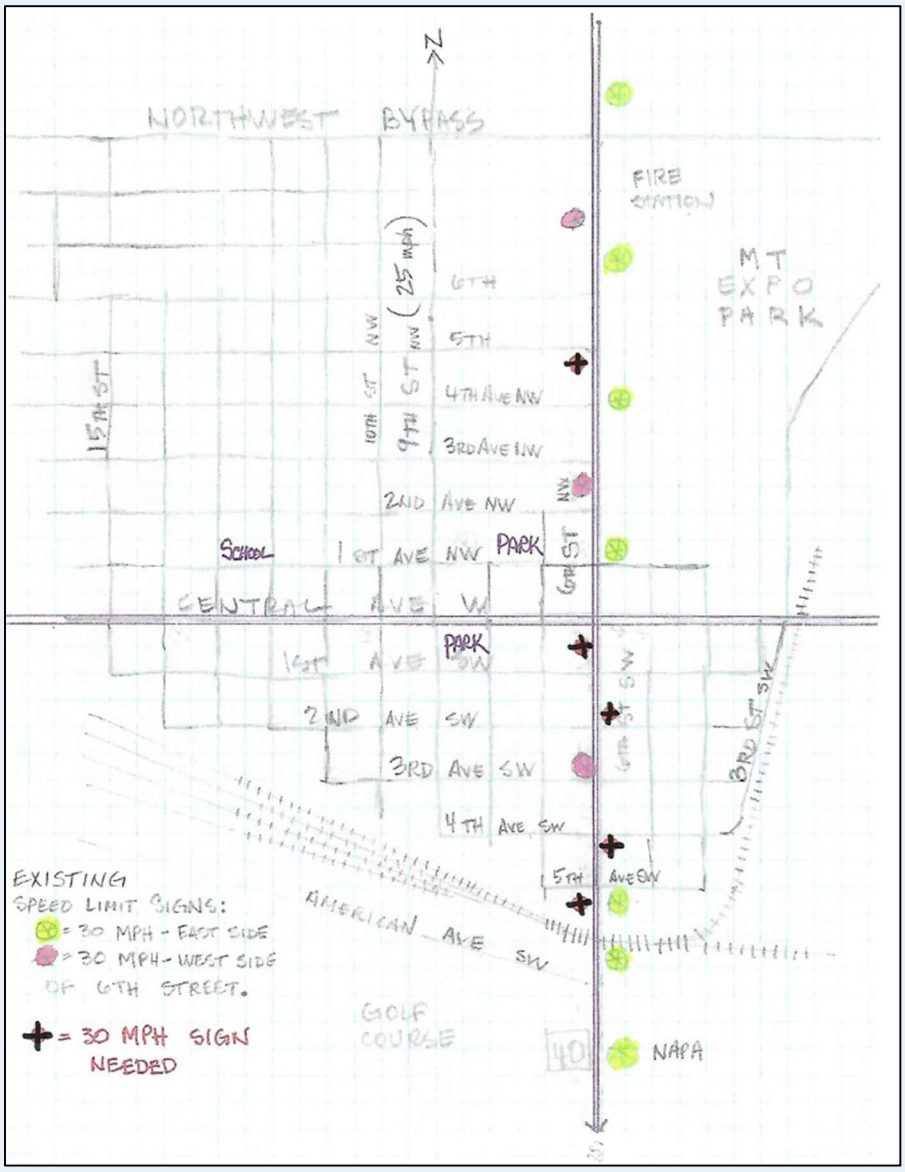
Please consider the following comments for addition to the LRTP:

1. The LRTP details the "Traffic Calming Program for Existing Streets", but this process is for local residential streets only; 6th Street SW is a principal arterial between Central Ave W and 5th Ave SW, but this is also a residential / mixed use area, and the speed limit is 30 mph. It would be helpful if the LRTP would include the process for residents to follow when it becomes necessary for citizens to address traffic conditions on arterial routes.

2. Appendix F: Facility Recommendations – 4.2 Annual Programs, P-4 Traffic Mitigation, p. 4: Please consider a pedestrian/bicycle project on 6th Street SW between Central Ave W and 4th Ave SW to improve safety, livability, and connectivity to river corridor and downtown amenities.
   Appendix F: Facility Recommendations – 4.4 Illustrative (Unfunded) Projects, p. 16: I-10 Speed Studies – Please add 6th Street SW from Central Ave W to American Way.

3. Appendix F: Facility Recommendations – 5.4 Spot Improvements, p. 52: Please add 6th Street SW spot crossing improvements at 2nd Ave SW and at 3rd Ave SW which would allow pedestrians and other non-motorized users (people on bicycles, in wheelchairs and strollers) to cross the street in a predictable and designated place. This would include highly visible marked crosswalks that glow in headlights with pedestrian crossing signs.

I feel that improving non-motorized transportation facilities would be a positive step in educating drivers in basic Montana traffic laws regarding sharing the road and yielding to pedestrians in crosswalks, and in increasing their awareness of other modes of transportation, which could help to improve their attitudes and perceptions towards non-motorized transportation users. Installation of marked crosswalks, pedestrian crossing markings/signs, and speed limit signs would be a start to re-

		establishing better driver behavior in this four block residential area on 6th Street SW. I have attached comments that I submitted at my neighborhood council meeting on two occasions. Thank you for this visionary plan, and I sincerely hope that my neighborhood street will be included. Sincerely, Susan Hillstrom 
04	**June 10, 2018** Chris Ward	• I don't understand how reconstructing River Drive to a 3 lane section between 25th and 38th will be an improvement. There are literally no driveways or street intersections in that segment. ○ A two lane should have virtually the same capacity as a three lane. Fig. 18 seems to suggest that there are expected to be

		capacity problems in this segment but the three lane proposal doesn't seem like it would be effective. o It seems like the v/c issue identified is based on the theoretical capacity of a two lane but in the absence of any turning vehicles the capacity may be a lot higher. • Various projects are described as constructing to arterial or collector standards. What these sections consist of is not defined in the document or in the references as far as I can tell. o Particularly with project I12 on 38th St N, the lack of clarity resulted in part of the road recently being apparently constructed to normal residential street width when the Montana Egg project was built. o It would be desirable to have 38th built to a higher standard but it isn't clear what the document is calling for. o Pedestrian project SPOT-10 notes don't apply to that location. • I believe there was some discussion about removing the shared use path project that arcs from 6th St SW over towards 14th St SW. SPOT-22 is still highly necessary as is a path connection from 18th Ave SW into Marketplace so that portion of the shared use path needs to remain in the document. • Figure 22 transit routes may need to be updated to reflect the recent route changes terminating at East Side Walmart instead of the Noon's convenience store. • 12th Ave N from 15th St N to River Drive should be a bike lane facility instead of shared use markings. • The plan should emphasize the bike route from 15th to the River's Edge Trail via 12th Ave N rather than through the congested 15th and River Drive Intersection. • SPOT-23 is relatively unnecessary with a good connection at SPOT-22. • The recommendations for SPOT-21 are incomprehensible in light of the terrain there and should be reviewed and probably dropped. • SPOT-22 will be an adequate connection from 25th St once bike/ped facilities are in place on River Drive. • It is not clear why widening 10th Ave S to 6 lanes east of 26th St (project I-31) would be necessary based on the v/c ratios shown in Fig 18. If the capacity is marginal could other less extreme measures like better access management be tried first? • I am interested in seeing what the results of the north subarea study are. Why does that need to be a separate study from the LRTP? I expect at some point those recommendations are going to need to be rolled into the overall plan. • Preservation of right of way for future arterials in the northwest area needs to be a high priority so development doesn't close off options.
05	**June 14, 2018** Chris Ward	• What is the expected life span of the 15th Street Bridge? Will it need to be rehabbed or replaced in the time period covered by the plan? The bridge is a major gap in the nonmotorized network and if it will be rehabbed pedestrian and bicycle facilities should be added if feasible structurally. The bridge should be indicated as a bike lane on the "visionary" nonmotorized network. o If it is likely to be replaced in the study period then the Smelter Ave should be changed back to an at grade intersection, as the railroad bridge is no longer needed. • N River Road should be changed to an underpass with no connection to 15th. • Wire Mill could be changed to a one-way southbound ramp. This would have many advantages including eliminating low clearance restrictions, eliminating maintenance of two bridges and retaining walls, improving southbound visibility of the signal at the bottom of the grade, reducing a dangerous grade, and restoring the street environment and connectivity in Black Eagle.

		• A new river crossing from NW Bypass to River Drive N at about 8th Ave N should be evaluated. In conjunction with a full interchange at Emerson Junction, this would turn NE Bypass/NW Bypass in to a very convenient cross-town route and the reduction in travel time would probably take a considerable amount of traffic (including through truck traffic) off 10th Ave S. • The River Drive projects should consider what volumes might need to be handled if this connection were in place. If this connection could reduce demand on 10th maybe some of the funds that are directed towards widening 10th could be reallocated to the NE/NW Bypass corridor. • The furthest east viable pedestrian crossing of the Missouri is the 9th/10th bridge. Until 1908 there was a pedestrian suspension bridge downstream of Black Eagle dam. This connection should be reestablished. It should be added as a shared use path link on the nonmotorized visionary network map. This would connect the north and south shore trails and provide bike/ped connectivity for Black Eagle. ○ If plans go ahead for a recreational site on the former ACM Smelter site as part of the EPA project then there would be additional need for a trail crossing at Black Eagle Falls.

APPENDIX B:
Goals and Objectives



Goals and Objectives

February 01, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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GOALS AND OBJECTIVES

1.0 INTRODUCTION

Development of goals and objectives for the *Great Falls Area Long Range Transportation Plan* (LRTP) is a critical first step in the transportation planning process. In addition to capturing all related information from previous community planning efforts, the goals and objectives lay out the general course of action for the LRTP development and represent the community's vision for the future transportation system. Accordingly, developing goals and objectives cannot be accomplished within a vacuum. It is an iterative process that continually evolves through guidance provided by the planning team, specific stakeholders, the general public, and the elected officials.

The goals and objectives described later in this memo are put forth in hopes of accurately reflecting the condition of planning within the general community, and more specifically reflecting the needs and desires relative to transportation.

The goals and objectives developed for the LRTP are connected concepts – that is they represent the desired end result of the community's transportation system once projects identified are implemented. Goals and objectives also provide direction on how to get to that end result. Factoring in specific requirements for Metropolitan Planning Organization (MPO) transportation planning relative to the ten planning factors contained in the Fixing America's Surface Transportation Act (FAST Act) legislation, it is clear the importance that the establishment of goals and objectives carries. Collectively, the goals and objectives will inform the planning process and set the course of action for the transportation system for years to come.

Goals represent the overarching statements of the LRTP intent and the direct elements of the community's vision.

Objectives are more focused statements of specific actions, measures or procedures that reflect how a particular goal can be attained.

2.0 LOCAL PLANNING PROCESSES

The following are various plans, policies, and studies developed at the local level which impact transportation in the Great Falls area. It is important to align the goals and objectives for the City of Great Falls with those defined previously to assure that local needs are met.

2.1. River Drive Corridor Study (2016)

River Drive North serves as a key route in the Great Falls transportation system and supports both local access and regional travel demand. The primary purpose of the corridor study was to develop a comprehensive, long-range plan for managing the corridor, addressing the transportation needs of the corridor, and determining appropriate improvements for the corridor. The following needs and objectives were established based on the analysis of existing and projected conditions, local plans, and input from resource agencies, stakeholders, and the public.

Need 1: Improve the Safety of the Corridor

Objectives (To the Extent Practicable)

- Reduce the frequency and severity of crashes.
- Improve roadway elements to current design criteria.
- Reduce vehicle conflicts.

Need 2: Accommodate Existing and Future Demands

Objectives (To the Extent Practicable)

- Reduce corridor congestion.
- Improve operations to achieve LOS standards.
- Accommodate large vehicles and freight movements.
- Accommodate non-motorized use.

Need 3: Minimize Adverse Impacts to the Environmental Characteristics of the Study Area

Objectives (To the Extent Practicable)

- Minimize adverse impacts to the Missouri River and surrounding wetlands.
- Avoid or minimize adverse impacts to historic, cultural, archaeological, and recreational resources.
- Preserve the scenic character of the corridor.

Other Considerations

- Local and regional planning efforts
- Funding availability
- Construction feasibility and physical constraints
- Impacts to existing residents and businesses in the area

2.2. I-15 Gore Hill To Emerson Junction Corridor Study (2015)

The *2014 Great Falls Area LRTP* identified the need to evaluate the Interstate System through Great Falls. As a result, this corridor study was prepared with the primary purpose of determining potential improvement options to address safety and operational concerns throughout the study corridor. A review and analysis of existing and projected conditions, local plans, and input from the public, study partners, and resources agencies, identified the following needs and objectives for the corridor.

Need 1: Improve the Safety of The Corridor

Objectives (To the Extent Practicable)

- Reduce the frequency and severity of crashes.
- Improve roadway elements to meet current design criteria to address identified safety concerns.
- Reduce conflicts between vehicles of varying types and speeds.
- Address identified crash trends and clusters.

Need 2: Accommodate Existing and Future Capacity Demands

Objectives (To the Extent Practicable)

- Maintain level of service (LOS) standards for mainline segments and interchange ramps.
- Improve operations and maintain LOS standards for intersections.

Need 3: Provide for The Mobility of People and Freight

Objectives (To the Extent Practicable)

- Provide for the movement and transfer of people and goods.
- Maintain the roadway for effective and prompt emergency response.

Other Considerations

- Environmental resource impacts of improvement options
- Local and regional planning efforts
- Funding availability
- Construction feasibility and impacts
- Security of the transportation system

2.3. Imagine 2025 Growth Policy Update (2013)

The *2013 Great Falls Growth Policy Update* replaces the previous growth policy which was last amended in/updated in 2005. The goals and policies in the Growth Policy Update were developed through countless public interactions, and as such have been vetted through the public process. The goals and policies in this planning document must be considered in the development of goals and objectives for the LRTP Update.

The goals and policies are crafted around four (4) primary focus areas: Social, Environmental, Economic and Physical. In all four focus areas there are transportation related policies interwoven throughout. For example, goal *SOC 1.2 - employ innovative strategies to promote, enhance and utilize the City's parks*, speaks to improving key intersection improvements to improve pedestrian access to Gibson Park (policy SOC 1.2.8). This transportation related component is embedded within the goals for the City's park system. Examples abound throughout the policies to improve transportation system form and function.

Perhaps most specific to transportation in the community is information developed under the "transportation and mobility" goal found under the Physical focus area. This goal is listed below, along with accompanying policies.

Transportation and Mobility

PHY 4.4 Increase mobility and the access of citizens to transportation alternatives throughout the City.

Policies

Phy 4.4.1 Improve the ability of residents to travel from home to work, schools, shopping, employment centers and activity centers.

Phy 4.4.2 Support efforts and programs that seek to improve school crossings, pedestrian access and the safety of those enroute to and from schools.

Phy 4.4.3 Enhance public access to community services and programs such as the library, Centene Stadium, Mansfield Center and other civic facilities and events.

Phy 4.4.4 Create a built environment that promotes easy access to safe walking, biking and other opportunities for physical activity.

Phy 4.4.5 Encourage, promote and support transit options for the community of Great Falls, including those required for the elderly and the disabled.

Phy 4.4.6 Review, update and adopt new standards and regulations that encourage pedestrian and bicycle-friendly development.

Phy 4.4.7 Provide sufficient resources to construct and maintain the trails and related facilities recommended in the City's *Comprehensive Park and Recreation Master Plan* and the *Bikeway Facilities Plan*.

Phy 4.4.8 Review and adopt formal design standards for all roadways.

Phy 4.4.9 Pursue grant funds to create a "Complete Streets" demonstration project or projects in the City.

Phy 4.4.10 Develop a formal ADA Transition Plan for public rights-of-way.

Phy 4.4.11 Implement elements of the *Downtown Access, Circulation and Streetscape Plan*, as opportunities arise.

Phy 4.4.12 Encourage development of network improvements that reduce emissions and idling times, reduce maintenance costs and increase efficiency of the road network. Examples include roundabouts, improved signal controls, construction of turn lanes and bike lanes, LED signal and street lighting, etc.

2.4. Cascade County Growth Policy Update (May 2014)

Concurrent to the City's update of their Growth Policy, Cascade County also recently completed a comprehensive Growth Policy Update. Much of the update to the County's Growth Policy reaffirms previous policy language and direction, however, where appropriate new data on population, employment and zoning was included. Perhaps the most relevant goal from the County Growth Policy for this LRTP Update is the transportation goal, as follows:

Transportation

GOAL 6: Promote and maintain a transportation system that provides safety, efficiency, and is cost effective.

Objectives

A. New additions to the transportation system should be compatible with the existing road system and coordinated with roads from other jurisdictions.

B. Transportation planning for new developments should support the Cascade County Growth Policy.

C. Ensure that all new roads, both public and private, are built to county design standards for new construction. These standards can be found within the Cascade County Subdivision Regulations.

D. Encourage provisions for multi-modal types of transportation including: bike lanes, trails, pedestrian facilities, etc.

F. Develop and implement road and bridge improvement standards and maintenance schedules.

G. Develop a policy and implementation program in cooperation with developers and school districts to provide walks, bridges and pathways for children to improve safety and reduce transportation costs between residential neighborhoods, schools and stores.

H. Develop secondary means of access, where practical, to settlements and subdivisions in order to improve safety and overall traffic circulation.

I. Consider the use of grants, Road Improvement Districts, and Rural Maintenance Districts to maximize funding strategies.

J. Coordinate transportation issues with wildfire and fire protection issues, policies and goals.

2.5. Downtown Access, Circulation and Streetscape Plan (April 2013)

Rather than speak in terms of goals and objectives, the *Downtown Access, Circulation and Streetscape Plan* developed a concise "Vision and Big Ideas" to articulate planning participants desire for the downtown area. Building upon work contained in the Downtown Master Plan, the following vision and three "big ideas" were formulated:

Vision

Downtown is the heart and center of Great Falls. Like the Missouri River, it is dynamic, fluid, attractive, and welcoming, connecting the City's heritage to its future. The River's Edge Trail, historic neighborhoods, and parks and open space support and enhance a unique mix of local shops, restaurants, entertainment and special events that make Downtown the place to be – day and night (Great Falls Downtown Master Plan). Three big ideas for Downtown's vision, as articulated in the Downtown Master Plan, which can be impacted by the recommendations that follow in this Plan include:

1. **Connected Downtown**: A transportation and circulation system that provides users with a variety of modes and a diversity in choices is fundamental to the future success of Downtown and will enhance Downtown's value as a place to live, work, shop and recreate. Quality infrastructure for walking, biking, driving and transit provides choice in terms of the safest, healthiest, most efficient and less-expensive route to reach Downtown's various amenities and destinations.

2. **Flourishing Downtown**: A flourishing Downtown is a key indicator of the overall economic health of Great Falls and plays a primary role in shaping the general perception of the City. By strengthening the existing business community and providing incentives for new investment, Downtown has the potential to evolve into a thriving place that enhances the image of the City and the region. Additionally, Downtown has great potential to capitalize on the presence of Malmstrom Air Force Base by providing services to airmen living on and off of the base and better serve students from the University of Great Falls, the Great Falls College, MSU Campuses. Downtown offers a different retail environment than the mall, big box, and neighborhood retail centers found elsewhere in the City and it should be targeted, celebrated, and built upon as a unique shopping and dining environment that can attract a larger segment of the local residents, employees, and students.

3. **Downtown Aesthetics**: Great Falls has a strong historic base and the clear center of this base is Downtown. Downtown's buildings, streetscapes, parks and the Missouri River play a primary role

in articulating the rich culture and heritage of the City and are a source of pride for the community. The unique aesthetics of Downtown are an asset that should be preserved, enhanced and celebrated to propel Downtown toward a vibrant and sustainable future.

2.6. Malmstrom AFB Joint Land Use Study (March 2012)

The goal of the Malmstrom Air Force Base (MAFB) Joint Land Use Study (JLUS) is to protect the viability of current and future missions at MAFB and the Malmstrom Missile Complex, while at the same time guiding growth, sustaining the economic health of the region, and protecting the public health, safety, and welfare. To that end, several key objectives were developed that speak to the reasoning for preparation of the JLUS, and what the potential benefits of the planning exercise may provide. The objectives are noted as follows:

- **Understanding**: Convene community and military representatives to identify, confirm and understand the issues in an open forum, taking into consideration both community and U.S. Air Force viewpoints and needs. This includes public awareness, education and input organized in a cohesive outreach program.

- **Collaboration**: Encourage cooperative land use and resource planning among the Base, Missile Complex, and surrounding communities so that future community growth and development are compatible with the training and operational missions at the installation and missile sites, while at the same time seeking ways to reduce operational impacts on adjacent lands within the City of Great Falls and the seven counties.

- **Actions**: Provide a set of mutually supported tools, activities, and procedures from which local jurisdictions, agencies, and the U.S. Air Force can select, prepare, approve / adopt, and use to implement the recommendations developed during the JLUS process. The actions include both operational measures to mitigate installation impacts on surrounding communities and local government and agency approaches to reduce community impacts on military operations. These tools will help decision makers resolve compatibility issues and prioritize projects within the annual budgeting process of their respective entity / jurisdiction.

2.7. Downtown Master Plan (October 2011)

The *Downtown Master Plan* provides a strategically focused vision with strategies to guide the growth and development of Downtown Great Falls. The plan seeks to build on the assets of Downtown and reinvigorate the area into a more active, vibrant, accessible and livable area that welcomes residents and visitors. Transportation objectives of primary importance to the LRTP effort include:

- Improve pedestrian connectivity and safety downtown.
- Develop a comprehensive downtown bicycle network to connect into a city-wide system and to connect to River's Edge Trail through signage and routes.
- Reduce or eliminate downtown one-ways.
- Improve connectivity for pedestrian and bicycles to the Missouri River, River's Edge Trail and Gibson Park.
- Develop a comprehensive downtown wayfinding system.
- Optimize parking for all stakeholders.
- Improve public realm to provide a safe, attractive and welcoming environment.

2.8. Great Falls Transit Development Plan (October 2010)

The most recent comprehensive planning document prepared for the Great Falls Transit District was the Transit Development Plan (TDP) Update (October 2010). Completed by LSC Consultants, the TDP Update provided a comprehensive examination of transit service operations, performance and needs. Chapter 2 of the TDP reiterates the mission of the Great Falls Transit District, that is:

> *"To provide a safe, reliable, affordable and fiscally sound transportation system for the people of Great Falls and Black Eagle, Montana."*

Paramount to this mission, goals and objectives were formulated through an intensive public process. The overarching goals, as specified in chapter 2 of the TDP Update, are as follows:

- **Goal #1**: Maintain the existing ridership base while attracting new riders.
- **Goal #2**: Continue to enhance the environmental sustainability of the transit system.
- **Goal #3**: Provide high quality, customer-oriented service.
- **Goal #4**: Provide efficient, effective, and safe services.
- **Goal #5**: Promote the transit service.

2.9. Great Falls Area LRTP Update (2009)

Vision(s), goals, and objectives were developed as part of the 2009 LRTP Update. The transportation planning vision described general, community-wide values of what the community desired in their transportation system. The goals of the Growth Policy and LRTP were developed, described and monitored to ensure compatibility with the vision. Specific objectives for the transportation system were also identified.

The developed transportation planning vision, goals, and objectives from the 2009 LRTP Update were as follows:

Vision

- Great Falls should be a city of cohesive, distinct, diverse, attractive, and safe neighborhoods with a compact land-use pattern. The transportation and land use decisions made by the City and County should be mutually supportive.
- Our community should have a safe, accessible, and walkable Downtown supported by unique or specialized employment, civic, mixed-use, and commercial activities with adequate vehicular circulation and parking.
- Our community should feature a transportation system incorporating many modes of travel that will protect air quality, minimize traffic congestion, and support compact, efficient land use patterns. The system should fully integrate with public and private transportation facilities.
- Our community should grow in compact patterns that facilitate pedestrian, bicycle, and transit travel. Walking should be a practical, safe, and enjoyable means of travel throughout all neighborhoods and shopping areas. Bicycling should become a more viable transportation choice for all residents and visitors in Great Falls.
- Our community should have a comprehensive and fully accessible public transit system.
- Our community should have streets, trails and walkways that are planned, built, landscaped, and maintained as safe and attractive public spaces linking a balanced system of open lands, natural areas, recreational facilities, schools, and parks with trails and urban streetscapes.
- Our community should continually seek to protect and improve air quality as the area grows, through the creation and implementation of comprehensive programs and policies.

Goals

The Transportation Element of the "then-current" Growth Policy included the following goals.

- Provide a safe, efficient, accessible, and cost-effective transportation system that offers viable choices for moving people and goods throughout the community.
- Make transit and non-motorized modes of transportation viable alternatives to the private automobile for travel in and around the community.
- Provide an open public involvement process in the development of the transportation system and in the implementation of transportation improvements to assure that community standards and values, such as aesthetics and neighborhood protection, are incorporated.

The following goal was also developed as a part of the LRTP Update to supplement the previously adopted goals.

- Provide a financially sustainable transportation plan that is actively used to guide the transportation decision-making process throughout the course of the next 20 years.

Objectives

The following objectives were developed during the 2009 LRTP Update to provide measurable milestones to assist in achieving the goals stated above.

- Implement a comprehensive public involvement process.
- Review all existing and on-going planning reports and studies.
- Conduct a thorough data collection effort.
- Analyze multi-model systems including transit, bicycle and pedestrian systems.
- Evaluate truck route system.
- Review accident history.
- Examine population and employment growth trends.
- Develop a 20-year traffic model.
- Identify current and foreseeable traffic problems.
- Develop a prioritized list of projects that address traffic problems and deficiencies.
- Update street standards.
- Identify Transportation Demand Management strategies to provide alternatives to private vehicle travel.
- Develop a traffic calming program.
- Conduct a financial analysis to ensure the plan is financially feasible and sustainable.
- Add elements required by SAFETEA-LU.
- Ensure fiscal constraint.

2.10. Medical District Master Plan (January 2007)

The *Great Falls Medical District Master Plan* was completed in 2007. Key constituents in the community, most notably the City of Great Falls, Benefis Healthcare, Great Falls Clinic, and others, noted the need for a more explicitly defined vision for the medical district due to significant growth in medical and health care related businesses and services. The following vision was developed by the planning sub-group:

1. Collaboration between major medical providers, adjacent property owners, neighborhood councils, and the City of Great Falls to implement the Master Plan.

2. Reinvestment, redevelopment and growth within the Medical District to increase interest in the area for living, working and business investment.
3. A vibrant mixed-use Medical District that attracts new residents and businesses while respecting existing land uses.
4. Exciting and enjoyable public spaces, streetscapes, trails, and physical connections between a mix of major medical facilities, offices, commercial areas, and residences.

As a follow-up to the development of the vision, the following goals & objectives were formulated during the planning process:

A. Develop a plan to facilitate the physical growth, development, redevelopment and renovation of the medical core area and its adjoining neighbors.
B. Develop a plan to produce a functional, attractive, interrelated and growth friendly medical district.
C. Enhance our community's economic competitiveness in attracting both individuals and businesses to locate in the Medical District.
D. Identify alternative financing approaches, capital strategies, and organizational models to support implementation of the Medical District Master Plan.

2.11. Missouri River Urban Corridor Plan (2004)

The primary purpose of this Plan was to present a vision for what is possible in the Missouri River corridor. As a community, Great Falls and Cascade County has done a good job with open space and recreation along the river. The Plan sets forth a series of strategies and actions to make the vision a reality. The Plan recognized that some development patterns along the river corridor represented an opportunity for more desirable, sustainable development that would capitalize on the river as an amenity and a resource.

Much attention in the Plan was paid to transportation as an integrated component of the overall vision for the corridor. To that end, "guiding principles" were formed that were interrelated in form and function. The four (4) guiding principles are as follows (note number 4 speaks to transportation):

1. From the standpoint of river dynamics, no riverside development or stream bank treatment will prevent the Missouri River from safely passing flood stage flows, nor will permanent development be allowed that will be damaged by those flows. (Note: This statement is not intended to prevent the placement of Properly designed and lawfully constructed piers, decks, docks, trails, or other appurtenant improvements associated with a substantial public interest that may in fact be damaged by major flood events).
2. Land and water based recreational values and opportunities associated with the river will be created, preserved, and enhanced, including public access to the river.
3. This Corridor Plan will promote beneficial, sustainable economic development that utilizes the river as an amenity while preserving and enhancing its ecological integrity and asset values. Specifically, water quality, natural shoreline vegetation, and wetlands will be restored, enhanced, or protected, and the environmental health of the river will not be compromised by development.
4. Major through transportation facilities in the river corridor are discouraged. Alternative routing of such facilities already in the corridor through responsible urban area transportation planning is encouraged.

3.0 STATE PLANNING PROCESSES

The following sections summarize statewide plans developed by MDT which have an impact on the transportation in Great Falls.

3.1. TRANPLANMT (2017)

TranPlanMT[1] is Montana's statewide long-range transportation plan and is an update to *TranPlan21*. MDT developed the *TranPlan 21* in 1995 and amended it in 2008. The *TranPlanMT* update is part of an ongoing process to identify transportation needs, evaluate public and stakeholder needs and priorities, assess future transportation concerns, and establish policy goals and strategies to achieve Montana's transportation goals. The plan guides MDT's efforts to plan, manage, and preserve a safe and efficient transportation system.

TranPlanMT sets policy direction for MDT based on public and stakeholder goals. A broad outreach effort involving MDT personnel, transportation stakeholders, public users, state, tribal, county, and municipal leaders helped identify transportation goals and strategies contained in the *TranPlanMT* document. These goals include:

- ***Goal (Safety):*** Improve safety for all transportation users to achieve Vision Zero: zero fatalities and zero serious injuries.
- ***Goal (System Preservation and Maintenance):*** Preserve and maintain existing transportation infrastructure.
- ***Goal (Mobility and Economic Vitality):*** Facilitate the movement of people and goods recognizing the importance of economic vitality.
- ***Goal (Accessibility and Connectivity):*** Preserve access to the transportation network and connectivity between modes.
- ***Goal (Environmental Stewardship):*** Support MDT's transportation mission through regulatory compliance and responsible stewardship of the built and natural environment.
- ***Goal (Business Operations and Management):*** Provide efficient, cost-effective management and operation to accelerate transportation project delivery and ensure system reliability.

3.2. COMPREHENSIVE STATE HIGHWAY SAFETY PLAN (2015)

The Montana Comprehensive Highway Safety Plan (CHSP) is just one of many statewide planning level documents that provides guidance and sets policies regarding a multitude of transportation related issues. Perhaps most applicable to the LRTP is the focus of the CHSP on improving comprehensive safety within the community. The Montana CHSP sets forth goals and objectives that are both broad and distinct at the same time. The CHSP, dated May 2015, outlines the following safety vision and goal for the State of Montana:

Vision

The vision for safety on Montana's roadways is clear - *Vison Zero*: zero fatalities and zero serious injuries.

Goal

To reduce fatalities and incapacitating injuries in the State of Montana by half in two decades, from 1,705 in 2007 to 852 by 2030.

[1] *TranPlanMT Plan Summary* (Draft), Montana Department of Transportation, June 2017, http://www.mdt.mt.gov/tranplan/

Vison Zero is a multipronged initiative with the goal of eliminating deaths and injuries on Montana highways. Using a combination of education, enforcement, engineering, and emergency medical response strategies, *Vision Zero* focuses on the following three emphasis areas:

- Roadway Departure and Intersection Crashes
- Impaired Driving Crashes
- Occupant Protection

3.3. Livability for Montana Transportation (2012)

A research project was commissioned by MDT that resulted in report number FHWA/MT-12-001/8210, titled *Livability for Montana Transportation*[2]. Due to heightened national dialogue on livability, MDT sought to more formally define what livability means for Montana and its communities and understand how livability relates to Montana's transportation needs. The study found that Montana has some unique characteristics that may have a bearing on measures of its livability. For example, sixty-two percent of Montanans live in areas where the population density is 800 people per square mile or higher, but those areas account for only 0.1 percent of the land area.

Along with Montana's unique character, the surveys conducted for the study indicate the state is also a good place to live. Survey respondents endorsed the belief that MDT projects add value to their quality of life. There were some consistent themes identified through the various tasks of this study. One size does not fit all, and any definition of livability should have some flexibility and scalability based on local needs and a community vision. A well-maintained road system, safety, public transportation systems, bike and pedestrian facilities, and winter maintenance are all important features of livability for Montana communities.

Based on research and outreach, the team proposed the following definition for livability in Montana as it relates to transportation:

> *"Provide a transportation system that emphasizes a safe, maintained road network; allows for multimodal transportation opportunities; and considers local community values."*

Furthermore, the following summary offers an expanded definition of livability elements that are a priority for Montana and its residents:

> *For Montanans, the most important elements of a livable community, although not necessarily transportation related, are friendly neighbors, rural character, availability of outdoor activities, access to high quality education and health care, abundance of natural scenic beauty, and availability of entertainment and cultural activities. However, transportation aspects that Montanan's perceive bring value to a community include:*
>
> *Primarily*
> - *A safe and well-maintained road network*
> - *Infrastructure and services that match local community values and needs*
>
> *Secondarily*
> - *Multi-modal alternatives to automobile travel—access to transit, rail, and air services*
> - *Bicycle and pedestrian facilities*

[2] *Livability for Montana Transportation*, Western Transportation Institute, March 2012, http://www.mdt.mt.gov/other/webdata/external/research/docs/research_proj/benchmarks/final_report_apr12.pdf

- *Access to nearby cities and towns for employment, health care services, and recreational activities through personal vehicles, transit, intercity bus, or other options*
- *Local enhancements that connect residents to the people and activities of their neighborhoods and communities*
- *Context-sensitive transportation planning that promotes the character of the community*
- *Preservation of the natural resources, scenic views, and rural sense of place that are valued by all Montanans*
- *Road surfaces that are well maintained in all weather conditions*
- *Transportation Infrastructure that improves local economies*

4.0 FEDERAL PLANNING REQUIREMENTS

Various laws and regulations at the federal level assist to inform the development of the LRTP. The laws and regulations set forth requirements to be considered in the transportation planning process or to be contained in the LRTP. These include FAST Act planning requirements, livability principles, environmental justice considerations, and potentially others. Transportation planning activities must provide for consideration of all modes of travel, and are to be continuing, cooperative, and comprehensive.

4.1. FAST ACT

The *Fixing America's Surface Transportation (FAST) Act*[3] became law on December 4, 2015. The FAST Act authorizes five years of funding for the nation's transportation infrastructure including highways and rail; public transportation; safety for highways, motor vehicles, motor carriers, and hazardous materials; and research, technology, and statistics programs. The FAST Act generally retains highway program structure established in the *Moving Ahead for Progress in the 21st Century Act* (MAP-21) and continues the focus on safety and streamlined project delivery. The long-term authorization bill allows for better development and planning of federally-funded highway projects, which in turn results in more, and safer, transportation systems for the traveling public.

Title 23 of the United States Code, section 134(f) (revised in SAFETEA-LU section 6001(h)) describes eight Federal Planning Factors issued by Congress to emphasize planning from a national perspective. The FAST Act added two additional planning factors. The ten planning factors are listed below:

1. Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.
2. Increase the safety of the transportation system for motorized and non-motorized users.
3. Increase the security of the transportation system for motorized and non-motorized users.
4. Increase the accessibility and mobility of people and for freight.
5. Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns.
6. Enhance the integration and connectivity of the transportation system, across and between modes, people and freight.
7. Promote efficient system management and operation.
8. Emphasize the preservation of the existing transportation system.

[3] *Fixing America's Surface Transportation (FAST) Act*, December 4, 2015, https://www.fhwa.dot.gov/fastact/

9. Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation.
10. Enhance travel and tourism.

While these factors typically apply to metropolitan and statewide planning efforts, considering them as potential goals for this LRTP is worthwhile.

4.2. Livability Principles From HUD/EPA/USDOT

Many federal partners are leading a growing effort to provide communities with a high quality of life that is increasingly sustainable. Livability is a national movement with local implications that are supported within the Great Falls community. Providing transportation options to improve access to housing, jobs, businesses, services and social activities are fundamental desires of most transportation system user groups. Active transportation results in a physically fit population, minimizes auto emissions, extends the life of transportation infrastructure, and delays the needs for infrastructure improvements. The Department of Housing and Urban Development (HUD), Environmental Protection Agency (EPA), and the US Department of Transportation (USDOT) have developed six guiding principles for communities to consider in their effort to achieve better access to affordable housing, more transportation options, and lower transportation costs, while supporting the environment. These principles are listed below:

1. **Provide more transportation choices.** Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.
2. **Promote equitable, affordable housing.** Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.
3. **Enhance economic competitiveness.** Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets.
4. **Support existing communities.** Target federal funding toward existing communities—through such strategies as transit-oriented, mixed-use development and land recycling—to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.
5. **Coordinate policies and leverage investment.** Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.
6. **Value communities and neighborhoods.** Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.

5.0 RECOMMENDED GOALS AND OBJECTIVES FOR LRTP UPDATE

Based on a review of relevant planning efforts within the community, five primary principles are suggested to carry forward for the LRTP. These principles are founded on the following:

1. The community desires a connected, smarter transportation system through land use and transportation planning. This type of system allows citizens to choose what mode of travel they desire, and makes travel more convenient while promoting an active lifestyle by choice for its citizens.
2. The community is a hub for local, regional and national industry. It is particularly growing as a freight hub serving various types of industries. The community embraces the opportunity to attract regional industry and support ongoing economic vitality.
3. Efficient travel and increased mobility is desirable to minimize transportation and associated costs.
4. Transportation influences quality of life. The community desires a transportation system that is compatible with the environment and context of the Great Falls area, with special consideration given to sustainability and conserving natural and cultural resources.
5. The community desires a safe and secure transportation system, and strives for a reduction in crashes, injuries and fatalities.

5.1. Proposed Goals and Objectives for LRTP

Goal 1: Maintain the existing transportation system.

The Great Falls Area transportation system is aging, and available funding is not sufficient for the necessary maintenance. Upkeep of roadways is reactive rather than proactive. There is often competition between funding for new projects as compared to maintenance and operations of the existing system. New or wider roadways are generally not being built, rather the short- and mid-term focus should turn to optimizing the existing transportation system to the greatest extent possible.

Objectives:

1.1. Maintain existing roadway systems to optimize their usefulness and minimize life-cycle costs.
1.2. Monitor the performance of key facilities and work with local and regional partners to identify critical deficiencies in the roadway network.
1.3. Use transportation project selection criteria to identify and prioritize maintenance activities and project development.
1.4. Relieve pressures on the existing transportation system through minor infrastructure improvements, maintenance and system preservation activities rather than expanding the current system.
1.5. Encourage reuse and/or redevelopment around existing transportation facilities.

Goal 2: Improve the efficiency, performance and connectivity of a balanced transportation system.

A transportation system that performs well allows users to choose multiple transportation modes and to move through those modes in a safe and efficient manner. An efficient system allows people to move from place to place in as direct a route as possible, allowing them to reduce the amount of time spent in

travel, the distance that must be traveled, and the amount of time spent in congested traffic. Connectivity allows citizens to make route decisions and mode choices based on traffic and road conditions, or desired destinations.

Objectives:

2.1. Ensure the current street network of collectors, minor arterials, principal arterials and the interstate is adequate to safely and efficiently handle projected traffic.

2.2. Promote the development of an effective roadway network through improvements in intersection and roadway capacity.

2.3. Improve opportunities for active transportation (non-motorized) as part of daily travel mode choice within the community by increasing pedestrian, bicycle and transit connections.

2.4. Ensure that mobility-challenged populations, such as low income, persons with disabilities, or senior citizens, have travel options in the Great Falls area.

2.5. Minimize cut-through traffic in residential neighborhoods.

2.6. Identify and reduce (or eliminate) freight movement impacts on area roadways and identify improvements to eliminate deficiencies with the objective of improving freight movement.

Goal 3: Promote consistency between land use and transportation plans to enhance mobility and accessibility.

Minimizing vehicle miles of travel and promoting alternative travel modes are fundamental objectives of a compact, livable urban environment. As the Great Falls Area population ages and the number of persons per household decreases, options in housing and transportation will be need to meet the demands of the population. Transportation improvements should be integrated with local land use planning to ensure the proper mix of roads, trails, transit, paths and other bicycle and pedestrian features co-exist.

Objectives:

3.1. Integrate land use planning and transportation planning to manage and develop the transportation system.

3.2. Use transportation project programming to encourage desired development patterns within the community and ensure new development is adequately served.

3.3. Develop and implement consistent access management and corridor preservation standards, ordinances and plans appropriate to the roadway network and land use throughout the area.

3.4. Ensure an environmentally responsible and sound transportation system that minimizes adverse environmental impacts within the community.

Goal 4: Provide a safe and secure transportation system.

Most community planning efforts recognize the desire for a safe transportation system. Community safety and security can be improved by transportation efforts in a number of ways. Reducing crashes, improving the ability of emergency responders to quickly and reliably respond to emergencies, and providing evacuation routes in the event of a natural disaster will all assist to improving safety and security. Educational programs that help travelers understand the particular safety concerns associated with various travel modes can also help all users travel with increased confidence and security.

Objectives:

4.1. Reduce the rates of fatalities and crashes occurring on all transportation facilities.

4.2. Identify barriers to effective and prompt emergency response.
4.3. Implement safety initiatives and educational programs for all modes of transportation.
4.4. Coordinate with freight operators and agencies on projects that can enhance the security of the freight transportation system in the region.

Goal 5: Support economic vitality of the community.

All economic activity relies on a functioning, diverse transportation network. Vehicle, freight, air, transit, rail and non-motorized infrastructure all have a purpose to serve when linking economic vitality to the costs of doing business. Transportation in terms of economic vitality is only one component of a successful business environment. High quality schools, diversity in housing types, low debt, availability of infrastructure, and access to a highly educated workforce all contribute to the economic success of a community.

Objectives:

5.1. Optimize the transportation system to meet the needs of the Great Falls Area, including the Great Falls International Airport, Malmstrom Air Force Base, Downtown Great Falls, employment centers, and industrial and commercial areas.
5.2. Provide attractive and convenient transportation facilities that attract and retain business, young professionals, families and older adults.
5.3. Facilitate the movement of goods and freight to commercial and industrial centers.

Goal 6: Protect and enhance environmental sustainability, provide opportunities for active lifestyles, and conserve natural and cultural resources.

Both the FAST Act planning factors and the livability principles from HUD/EPA/USDOT point to quality of life concerns in the development of LRTP's. Not only are impacts to the environment taken more seriously, but increasingly Great Falls Area citizens are demanding a more holistic approach to transportation. The preservation of natural, historic and cultural resources, as well as promoting a healthy, active lifestyle, are priorities of this LRTP and current Federal transportation planning guidance.

Objectives:

6.1. Promote transportation projects, plans and/or programs that encourage reducing fuel consumption, reducing vehicle miles of travel, and thereby minimizing air pollution.
6.2. Coordinate transportation planning activities with appropriate federal, state, and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation.
6.3. Engage stakeholders and the public in the decision-making stage of the transportation planning process.
6.4. Coordinate transportation planning activities with local and regional land use planning activities, including the City and County Growth Policy Updates.

Goal 7: Maximize the cost effectiveness of transportation.

Transportation facilities that provide options to the public, reduce the time spent traveling, reduce fuel consumption, and make the best use of limited public funds for infrastructure improvements are desirable. Not only are costs related to the cost of building facilities, but there are also associated costs of time spent in vehicles.

Objectives:

7.1. Identify available funding mechanisms potentially including federal and state gas tax revenue, impact fees, transportation bond issues, local option gas taxes, and other revenue funding sources used in similar cities.

7.2. Encourage cooperation between public, private and non-profit organizations in the development, funding, and management of transportation projects.

7.3. Promote cost-effective recommendations that balance transportation system needs with available funding and expected expenditures.

5.2. Alignment of Goals with FAST Act and Livability Principles

As a MPO, it is necessary to ensure the alignment of local LRTP transportation goals with the FAST Act planning factors. Additionally, the Livability Principles from HUD/EPA/USDOT, while technically not Federal law, are worthy national transportation process objectives that should be reviewed and considered. **Table 1** depicts the relationship between the proposed Great Falls Area LRTP goals, the required FAST Act planning factors, and the objectives contained in the Livability Principles from HUD/EPA/USDOT.

Table 1: Alignment of Goals with FAST Act and Livability Principles

			Great Falls Area LRTP Goals						
			Goal 1: Maintain the existing transportation system.	**Goal 2**: Improve the efficiency, performance and connectivity of a balanced transportation system.	**Goal 3**: Promote consistency between land use and transportation plans to enhance mobility and accessibility.	**Goal 4**: Provide a safe and secure transportation system.	**Goal 5**: Support economic vitality of the community.	**Goal 6**: Protect and enhance environmental sustainability, provide opportunities for active lifestyles, and conserve natural and cultural resources.	**Goal 7**: Maximize the cost effectiveness of transportation.
FAST ACT Planning Factors	**1**	Support the **economic vitality** of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.					✓		✓
	2	Increase the **safety** of the transportation system for motorized and non-motorized users.				✓			
	3	Increase the **security** of the transportation system for motorized and non-motorized users.				✓			
	4	Increase the **accessibility and mobility** of **people and for freight**.		✓	✓				
	5	**Protect and enhance the environment**, promote **energy conservation**, improve the **quality of life**, and promote **consistency between transportation improvements** and State and local planned growth and economic development patterns.			✓			✓	✓
	6	Enhance the **integration and connectivity** of the transportation system, across and between modes, people and freight.		✓	✓				
	7	Promote **efficient system management and operation**.		✓					
	8	Emphasize the **preservation of the existing transportation system**.	✓						
	9	Improve the **resiliency** and **reliability** of the transportation system and reduce or mitigate stormwater impacts of surface transportation.		✓				✓	
	10	Enhance **travel** and **tourism**.					✓		
Livability Principles	**1**	Provide more **transportation choices**.		✓					
	2	Promote equitable, **affordable housing**.		✓	✓				✓
	3	Enhance **economic competitiveness**.					✓		
	4	**Support** existing **communities**.	✓	✓	✓	✓		✓	
	5	Coordinate policies and **leverage investment**.							✓
	6	**Value communities and neighborhoods**.	✓	✓	✓	✓			

APPENDIX C:
Freight and Security



FREIGHT AND SECURITY

February 01, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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FREIGHT AND SECURITY

1.0 INTRODUCTION

Two technical memos were produced by Cambridge Systematics for the 2014 Long Range Transportation Plan (LRTP), *Freight and Goods Movement*[1] and *Transportation Security*[2]. Each of these memos have been reviewed for relevancy to the 2018 LRTP and updated where appropriate to reflect current conditions using the most current data available. The updated information from the two previous memos have been included in this *Freight and Security* technical memo.

2.0 FREIGHT AND GOODS MOVEMENT

Moving goods efficiently and safely in the region is critical to the economy and quality of life in the Great Falls Area. Local businesses engaged in industrial, agricultural, office and retail activities rely on timely deliveries to supply finished goods and services to their customers. These businesses contribute primary jobs that grow the region's economy and maintain long-term economic competitiveness. Goods movement is important to local consumers, as increasing numbers of people shop online and expect goods delivered quickly to their homes. The Great Falls Area is part of long-distance goods movement corridors supporting interstate and international commerce.

Goods movement affects all modes of transportation and a broad mix of land uses in the Great Falls Area. Goods move through the region alongside drivers, pedestrians, cyclists, and passengers traveling by bus, rail, and air. The goods movement network connects and passes through commercial districts, residential neighborhoods, and parks. Demand for goods movement is increasing as the region's economy and population grows. Integrating goods movement into the transportation system and local land uses is critical to protecting safety and quality of life.

The following sections describe the role of goods movement in the regional economy and explain how it relates to the regional transportation system. The following questions about goods movement today and in the future, are addressed:

- How does goods movement support the economy and quality of life in the Great Falls Area, and across the state?
- What kinds of goods are transported to, from, and through the Great Falls Area, and how are they moved through the region?
- How will the demand for goods movement change in the future?

The information included herein comes from a range of publicly available resources, most notably from the City of Great Falls, the Great Falls Development Authority, the Cascade County Commission, and the Montana Department of Transportation (MDT).

2.1. GOODS MOVEMENT AND THE REGIONAL ECONOMY

Goods movement is very important to the Great Falls Area and Montana, serving as a key destination and transfer point for goods carried regionally by truck, rail, and air. Perhaps more importantly, goods movement supports the well-being of local residents and businesses. Businesses receive key inputs and

[1] *Freight and Goods Movement*, Cambridge Systematics, November 19, 2013
[2] *Transportation Security Technical Memorandum*, Cambridge Systematics, October 14, 2013

supplies to keep their operations going, and rely on shipping networks to get their products to customers. Residents rely on goods movement to support day-to-day activities such as buying groceries, going out to dinner, and online shopping.

2.1.1. Local Context

The Great Falls Area is the primary population and employment center for north-central Montana. This includes areas encompassed by Cascade County, the Sweetgrass Economic Development region[3], and the Bear Paw Development Corporation. The Great Falls Area's industrial sectors have grown steadily over the past 30 years. This growth supports the City of Great Falls' nearly 59,500 residents and 30,000 jobs, and Cascade County's population of about 82,000 people and nearly 41,500 jobs. **Figure 2.1** illustrates the City of Great Falls' employment sectors in 2012. The five sectors include management and business, sales, professional services, natural resources and construction, and production and transportation. Military employment is not included in this analysis. The largest sector, management, business, science and arts, employs 30 percent of the City of Great Falls' workforce. Sales and office jobs represent 27 percent of the region's employment. Together these sectors represent nearly two-thirds of employment, with services comprising one-fifth of employment, and production, transportation, natural resources, and construction also making up one-fifth of the region's jobs.

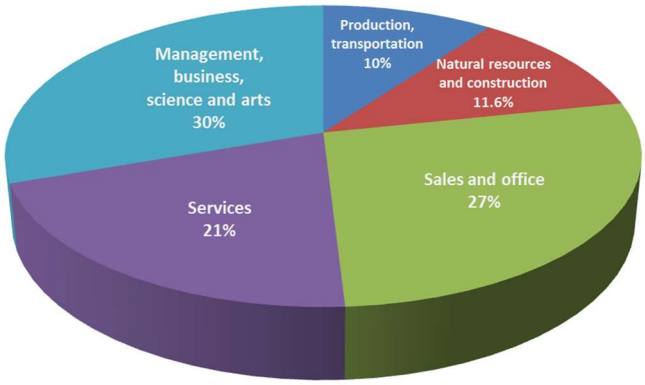


Figure 2.1: Great Falls Non-Military Jobs by Sector (2012)

Source: 2025 Imagine Great Falls Growth Policy Update, City of Great Falls, 2013. Military employment is not included in these figures.

Each employment sector relies on a high-quality goods movement network. To understand how these employment sector relates to the goods movement network is to look at three main employment categories, including heavy industry; service, retail and management; and military.

Heavy Industry. Goods movement is typically associated with heavy industry. Businesses in these industries make location decisions based on access to efficient, secure, and safe transportation infrastructure to support their growth. Heavy industry has an important role in the Great Falls Area. **Figure 2.1** illustrates that two employment sectors – production and transportation, and natural resources and construction – make up about 21 percent of jobs. These industries are expecting continued growth in the Great Falls Area to support developments in oil and gas extraction and refining, and agriculture. Notable products on the goods movement system include oil and gas extraction materials and equipment, grains and other perishables, aerospace equipment and parts, and wind energy equipment and supplies.

[3] The Sweetgrass Economic Development Region includes Glacier, Toole, Pondera, Teton, Conrad and Cascade Counties.

Examples of employers in these industries include the Calumet Montana Refining, Pacific Steel and Recycling, ADF Group (Steel Fabrication), Pasta Montana, Malteurop and General Mills.

Service, retail, and management. Goods movement is critical to the local service, retail, and management businesses that account for nearly 80 percent of the jobs in the City of Great Falls. Businesses in these industries are less likely to make location decisions based on goods movement access. Service and office businesses are more concerned with customer and employee transportation access. However, all rely on efficient shipment of goods to conduct day-to-day business. Retail businesses, for example, require regular, large shipments of products to keep stores stocked. Management offices require office supplies and mail shipments, and health care facilities require medical diagnostic equipment and pharmaceuticals. Service and office businesses are expected to continue to grow in the Great Falls Area because of a skilled workforce, growing demand for health care, and the natural environment that attracts tourists from around the world. Examples of employers in these industries include Benefis Health System, Wal-Mart, N.E.W. Customer Service, and local government offices.

Military. The military maintains a strong presence in the Great Falls Area. Malmstrom Air Force Base (AFB) employs over 4,400 military-related personnel. The Montana Air National Guard has over 800 military-related personnel. Malmstrom AFB's direct and indirect economic impact totaled over $330 million, and expenditures for construction, services, materials, equipment, and supplies totaled about $69 million in 2012.[4] The AFB relies on an efficient and secure goods movement network to transport these goods to and from the base. In particular, the AFB relies on roadway connections to Great Falls International Airport, which is a key component of the military transportation network.

2.1.2. Interstate and International Context

Goods movement routes in and around the Great Falls Area play a significant role on the state and national economies. The key statewide industries reliant on the goods movement system are oil and gas extraction, and agriculture.

Oil and gas extraction. The oil and gas industry represents a nine-billion-dollar economic sector in Montana, with 4,600 jobs across the state in exploration, production, and refining. Expansion in this industry is leading businesses to locate in the Great Falls Area due to its skilled workforce, access to major transportation routes, and proximity to oil and gas resources such as the Alberta Basin Bakken Fairway and Williston Basin oil fields. The Calumet Montana refinery in Great Falls is currently expanding and will generate increased volumes of crude and refined oil products.

Agriculture. The Great Falls Area is located near the "Golden Triangle" of Montana, known for producing large quantities of wheat between the Cities of Great Falls, Conrad, and Havre. Related industries process the wheat to supply consumer product manufacturing. The greater Sweetgrass Economic Development Region is known for its prairie grazing lands, other small grains such as barley, forage crops, and forage animals. Demand for organics and natural products has been growing quickly. The region has competitive advantages for agri-processing, such as high-quality commodities, energy sources (i.e., electricity, natural gas, and oil), rail transportation, water resources, and a skilled workforce. Expansion of local agri-based processors is being promoted, and some increase is likely.

[4] 2025 Imagine Great Falls Growth Policy Update, City of Great Falls, 2013.

2.2. Existing Goods Movement System

The existing transportation system facilitates considerable goods movement to, from, and through the region. This section describes the types and quantities of goods moved, how the goods are moved, the routes and freight facilities, and gaps or needs on the regional goods movement transportation system.

2.2.1. Commodities and Products Overview

Montana exports over 61 million tons of goods, with a total value of over $6.6 billion dollars.[5] Over 75 percent of outbound freight tonnage is coal products. Other leading outbound commodities include minerals, metallic ores, and cereal grains. However, the top outbound commodities by value are more diverse. The “other” commodity category makes up 54 percent of commodities value. Coal products make up about 20 percent of outbound value, with the remaining value distributed across commodities including mixed freight, printed products, cereal products, articles-base metals, and machinery.

About 11 million tons of goods terminate in Montana, valued at about 12.1 billion dollars. These inbound goods are mixed, with over 50 percent of weight (5.8 million tons) categorized as “other”. Wood products make up 11 percent of inbound goods by weight, with other top commodities including coal, wood, cereal grains, chemical products, and fertilizer. By value, 42 percent of inbound goods are in the “other” commodity category, and 19 percent in mixed freight. Other inbound goods leading in value include machinery, chemical products, meat products and miscellaneous manufactured goods.

2.2.2. Goods Movement by Transportation Mode

Montana is part of a trade corridor linking midwestern and northwestern port markets. This leads to a large share of through-bound goods movement. For rail, 74 percent of goods by value and over half of the goods by weight pass through Montana.[6] Trucking serves a greater share of locally serving trips – those originating and terminating in Montana – due to the ability of trucks to serve diffuse markets. While the Great Falls Area is affected by through trips on the highway and rail networks, locally serving trips have the greatest impact on the regional economy and quality of life.

Trucks carry 59 percent of goods by value that originate in Montana, and 82 percent of goods by value destined for Montana. **Figure 2.2** illustrates the value of freight transportation in Montana by transportation mode. Truck and intermodal modes represent large proportions of overall value because more valuable commodities tend to be transported as containerized or truck trailer freight.

[5] Montana State Rail Plan, MDT, 2010.

[6] Montana State Rail Plan, MDT, 2010. Does not include pipeline and intermodal shipments.

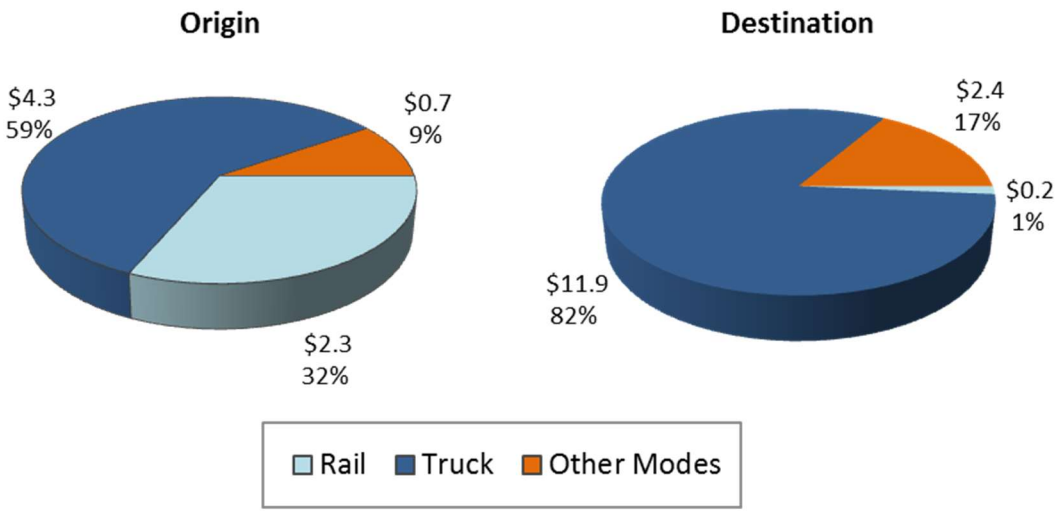


Figure 2.2: Montana Freight Value by Mode (2007, Billions of U.S. Dollars)

Source: Montana State Rail Plan, MDT, 2010. Does not include pipeline and intermodal shipments.

The Port of Sweetgrass is located along I-15 approximately 120 miles north of Great Falls, and is Montana's largest international port of entry. It is the only port in western Montana that is open twenty-four hours a day. It is located near three of western Canada's largest cities: Calgary, Lethbridge, and Edmonton. Together, these cities have a population of approximately 1.25 million. Approximately 980,000 people travel through the Sweetgrass Port of Entry each year.[7] After passing through the Port of Sweetgrass, trucks largely travel on I-15 through Great Falls and continue to destinations to the south, southeast, and west.

Great Falls is located along the Canamex Trade Corridor, which was designated as a High Priority Corridor by Congress in the 1995 National Highway Systems Designation Act. I-15 is the designated corridor through Great Falls and northern Montana. South of Great Falls to Mexico the corridor includes a combination of roadways. The corridor's main objective is to facilitate trade between these nations and strengthen its position in the global economy.[8]

Rail accounts for 32 percent of the freight value originating in Montana, but it accounts for only one percent of the freight value with a destination in Montana. This is partly due to the fact that trucks (hauling containers or trailers) are better suited to distributing high-value finished goods to diffuse markets (e.g. grocery stores, retail stores). Developing industrial sectors in Montana, such as oil and gas extraction, move goods primarily by truck freight, while agriculture-related industries transport goods both by truck and rail.[9]

Great Falls International Airport sees a significant share of Montana air cargo, which extends into southern Alberta, Canada. Large distances and rough terrain between cities and towns often make air travel the most efficient mode of transportation. FedEx Express uses the airport as their statewide hub,

[7] U.S. Customs and Border Protection, *Sweetgrass Station,* https://www.cbp.gov/border-security/along-us-borders/border-patrol-sectors/havre-sector-montana/sweetgrass-station. Accessed January 2018.
[8] Canamex Corridor Coalition, *CANAMEX Corridor -The Canamex Trade Route.* http://www.cbp.gov/xp/cgov/border_security/border_patrol/border_patrol_sectors/havre_sector_mt/stations/sweetgrass.xml. Accessed October 2013.
[9] *Great Falls Regional Transportation Task #7*, Cascade County Commission, 2011.

linking smaller flights to communities within the state, and linking to hubs in other states. FedEx also contracts with the United States Postal Service to carry first class mail.

There were about 42,000 annual enplanements on average in 2011. **Table 2.1** breaks out the enplanements by purpose and compares Great Falls International Airport to Billings Logan International Airport and Helena Regional Airport. These two airports provide a comparison of operations at other Montana airports that are similar in size to Great Falls International Airport.

Table 2.1: Great Falls International Airport Infrastructure

	Great Falls International	Helena Regional	Billings Logan International
Number of Terminal Gates	4	2	7
Cargo Apron Area (sq.ft.)	531,000	Fixed Base Operator Ramp	296,500
Cargo Warehouse (sq.ft.)	72,000	None	27,000
Annual Operations	32,599	38,884	78,740
% Commercial	12%	4%	13%
% Air Taxi	32%	14%	33%
% GA Local	22%	35%	30%
% GA Itinerant	28%	33%	23%
% Military	5%	14%	1%

Source: FAA 5010 Form, Airport Records, http://www.gcr1.com/5010web/, accessed February 2018.

Air cargo transport trends at Great Falls International Airport declined in response to the economic recession, and due to reduced FedEx Express' weekend service in 2006. **Table 2.2** presents the total air cargo tonnage from 2005 to 2010.

Table 2.2: Great Falls International Airport Air Cargo 2005 to 2010

	2005	2006	2007	2008	2009	2010
Tons Air Cargo	22,257	20,187	18,192	17,525	16,624	15,391
Change from previous year	Na	-9%	-10%	-4%	-5%	-7%

Source: Great Falls Regional Transportation Task #7, Cascade County Commission, 2011.

Air cargo is typically high value and relatively low weight, so trends in air cargo by weight is not necessarily indicative of economic strength. Great Falls International Airport has regularly transported cargo that supports the local economy. Common inbound goods include:

- aerospace parts and equipment;
- legal and financial documents;
- cell phones;
- wind energy parts and equipment to repair local wind turbines;
- mining parts and equipment; and
- oil and gas extraction parts and equipment.

Other goods arrive bound for local medical facilities, including diagnostic equipment, pharmaceuticals, and medical devices. Other inbound goods include flowers, tractor, and heavy equipment parts. Outbound air cargo is based on the local tourism industry (related to hunting and fishing), as well as financial and management service and aerospace industries. The top local commodities include:

- meat products related to the local hunting and fishing industry;
- taxidermies;
- music concert equipment;
- documents and forms; and
- aerospace related equipment and supplies.

2.2.3. Origins and Destinations

Much of the locally serving goods movement is destined for industrial or commercial districts. Heavy industrial areas (I-2 District) are located within the northeastern quadrant of the city, along Highway 87, heading northeast from Great Falls, or along River Drive North on the east side of Great Falls. There are some light industrial districts (I-1 District) just north of a high-density residential district (R-3 District) adjacent to 8th Avenue North, and also on the west side of Great Falls between the Missouri River and I-15. The latter area is the location of the BNSF rail yard. Great Falls International Airport is an important location in the area's freight network, as goods move to and from the region via this location. **Figure 2.3** illustrates the City of Great Falls zoning map, indicating where these districts are.

Goods move to and from commercial districts of the city as well, many of which are located on the city's south side, along 10th Avenue South. The Central Business Core (C-4 District) is located north of 10th Avenue South, just east of the Missouri River. Goods moving to the Central Business Core arrive by various arterials connecting to the Core, including:

- 2nd Street South, River Drive North and South, 5th/6th Streets South one-way couplet;
- 1st/2nd Avenues North one-way couplet;
- 9th Street North and South; and
- Central Avenue West/1st Avenue North.

More information on truck routes is provided in the "Routes and Facilities" section and **Figure 2.5** below.

Cascade County has two industrial zoning designations: Light Industrial (I-1) and Heavy Industrial (I-2). Areas of I-2 zoning are found in and around the unincorporated area of Black Eagle, along several miles of Vaughn Road, and southwest of Great Falls International Airport adjacent to the Tri-Hill Frontage Road. Areas of I-1 zoning are spread across the same areas, with additional zoning in areas near the Emerson Junction interchange and adjacent to the NW Bypass. All of these areas are located outside of the City limits but within the study area boundary for the LRTP. These areas are likely to have future industrial uses develop over the 25-year planning horizon in the LRTP.

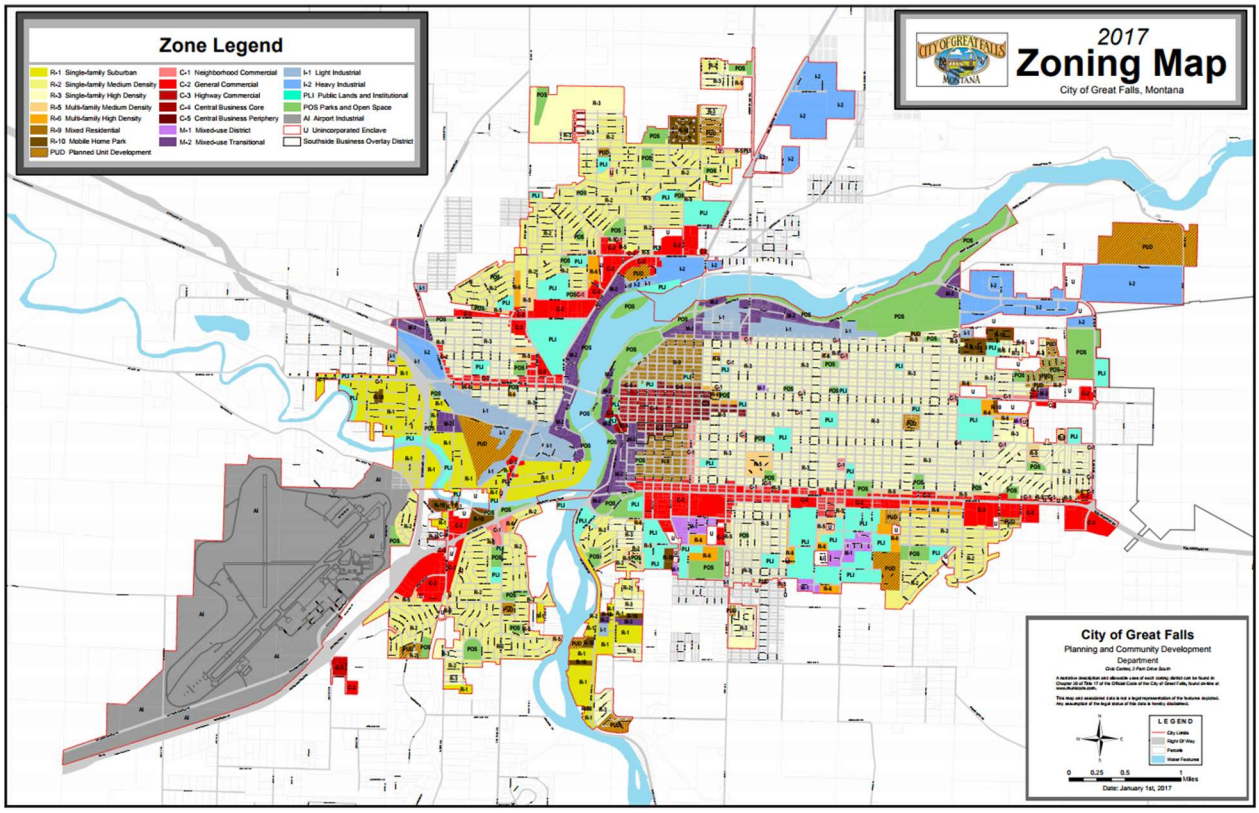
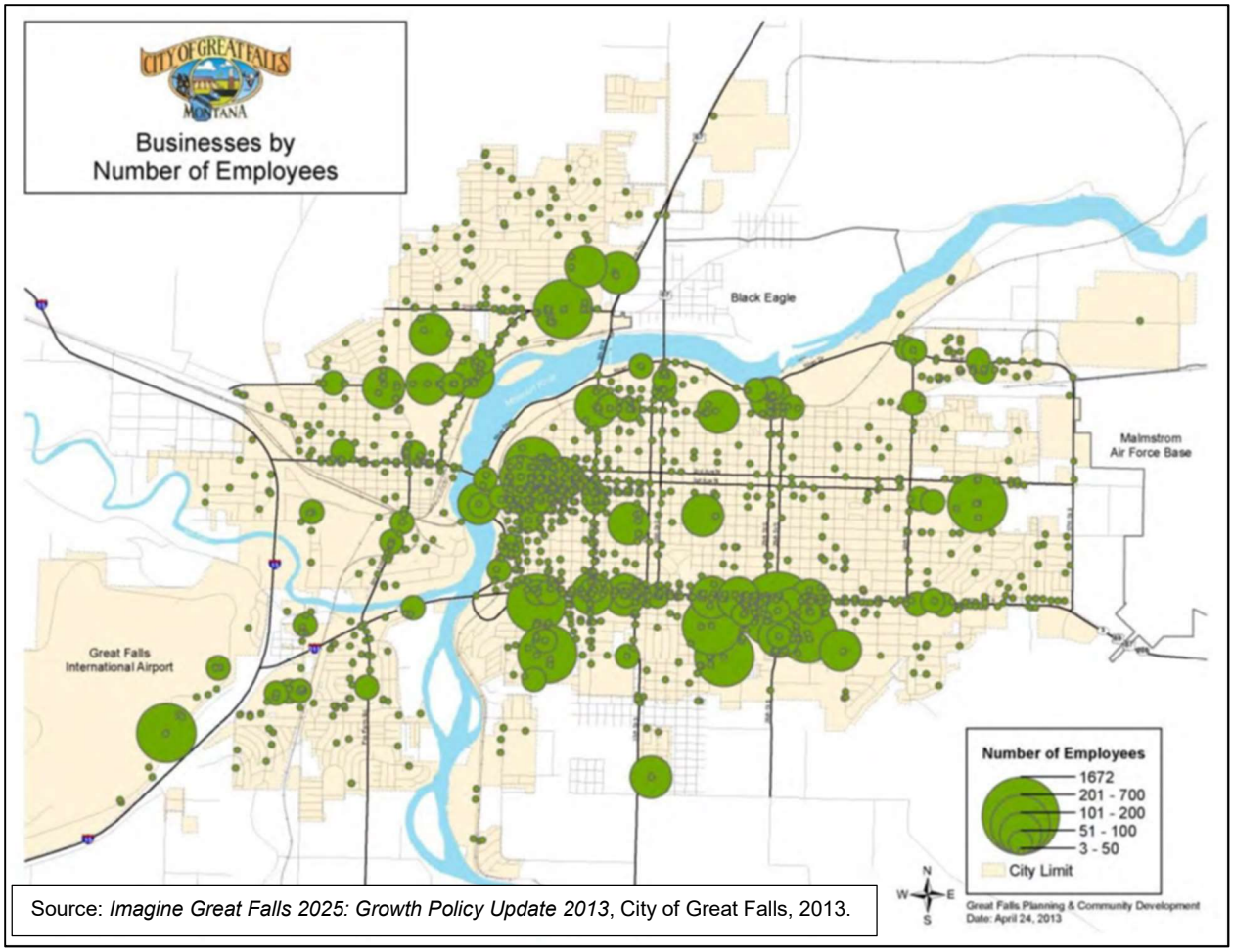


Figure 2.3: City of Great Falls Zoning Districts

Figure 2.4 presents employment intensity and location in the City of Great Falls. The size of a symbol corresponds to the number of employees (i.e. the larger the bubble, the more employees work at that establishment). The number of employees is one indicator of economic activity. It can indicate total economic output of a business. The number of employees is also associated with local spending, as employees spend their income in the region. Providing efficient goods movement to and from employment clusters supports business activity and helps preserve jobs in the region. This is important for retail and office professions as well as manufacturing and industrial sectors. Retail stores, offices and other establishments, for example, located near River Drive North and 1st Avenue North rely on regular shipments of supplies and materials to support employee activity. The University of Great Falls and Great Falls Clinic Medical Center rely on regular shipments of medical equipment, food, and other products to serve thousands of customers and employees. The ability to receive goods on a regular basis is especially critical in industrial job centers. Employment in **Figure 2.4** shows significant activity in outlying areas and near Great Falls International Airport near existing industrial activities. Malmstrom AFB has over 4,000 employees, but is not represented in this map.

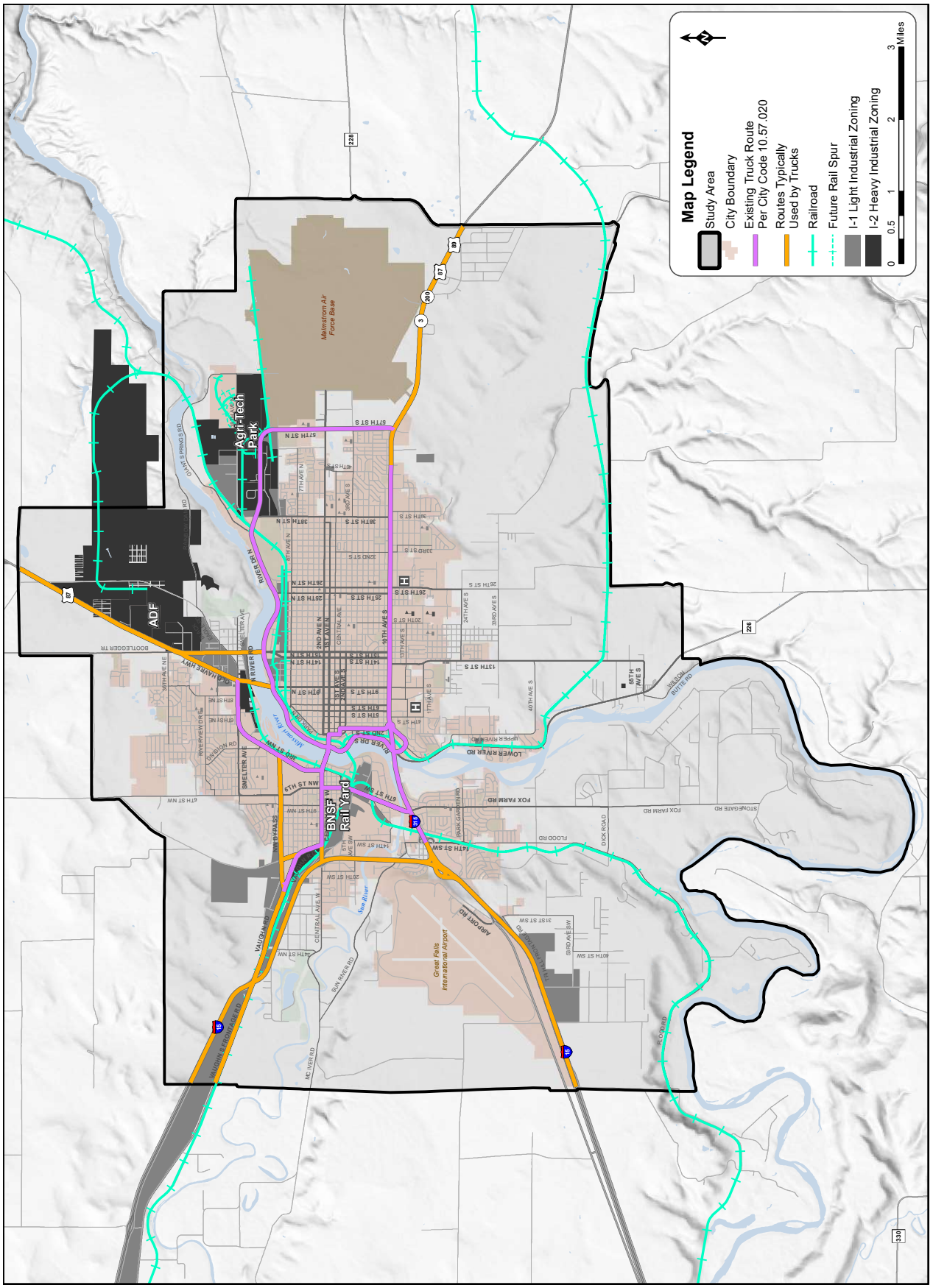


Source: *Imagine Great Falls 2025: Growth Policy Update 2013*, City of Great Falls, 2013.

Figure 2.4: City of Great Falls Business Location by Number of Employees

2.2.4. Routes and Facilities

The Great Falls Area's goods movement network benefits from truck, rail, and air transportation modes that facilitate goods movement throughout the region. **Figure 2.6** presents the goods movement routes and facilities in the Great Falls Area, which are discussed in greater detail in the following sections.


Map Legend
Study Area
City Boundary
Existing Truck Route
Per City Code 10.57.020
Routes Typically
Used by Trucks
Railroad
Future Rail Spur
I-1 Light Industrial Zoning
I-2 Heavy Industrial Zoning
0
0.5
1
2
3
Miles
Malmstrom Air Force Base
Agri-Tech Park
ADF
BNSF Rail Yard
Great Falls International Airport
Missouri River
Sun River
River Dr N
River Dr S
Lower River Rd
Fox Farm Rd
Flood Rd
Dick Road
Stonegate Rd
Upper River Rd
Northern Butte Rd
Airport Rd
Sun River Rd
Vaughn Rd
Vaughn Frontage Rd
Mo River Rd
Old Havre Hwy
Bootlegger Tr
Gibson Park Dr
Smelter Ave
Central Ave
Central Ave W
Park Garden Rd
Tri-County Rd
Ms Gorski Rd
Ploger Rd
Gore Hill Rd
Grant Springs Rd
Tension Rd
Refinery Rd
Gibson Park
Gibson Park Dr N
Gibson Park Dr S
Gibson Park Dr W
Gibson Park Dr NE
Gibson Park Dr NW
Gibson Park Dr SW
Gibson Park Dr SE
Gibson Park Dr E

TRUCKS

Figure 2.5 illustrates the routes generally used by trucks in the Great Falls Area. Official truck routes to be used by through trucks are identified in the City of Great Falls city code[10]. Typical truck routes are those that are outside the municipal boundary and connect to the official truck routes, forming complete goods movement routes. The official truck routes are:

- 10th Avenue South from the west City limits to the east City limits;
- The Northeast Bypass from the intersection at 57th Street South and 10th Avenue South, north and then westerly to the Tenth Street Bridge;
- River Drive from its connection with 10th Avenue South at or near the Warden Bridge to the 1st Avenue North Bridge; 1st Avenue North from Park Drive westerly through the 1st Avenue North Bridge; Central Avenue West from the west end of the 1st Avenue North Bridge to the west City limits on the Vaughn Highway;
- 3rd Street Northwest and Smelter Avenue from Central Avenue West to the northeasterly City limits;
- 2nd Street from the 10th Avenue South approaches north to 1st Avenue South;
- 1st Avenue South from 2nd Street, west to Park Drive; Park Drive from 1st Avenue South to 1st Avenue North;
- 6th Street Southwest from Central Avenue West to 10th Avenue South; and
- River Drive from 1st Avenue North to the 10th Street Bridge;

Trucks generally travel on I-15 to access markets outside the region. Locally-serving trucks access the city via the NW Bypass or Central Avenue West. From the southwest, trucks access the city on Country Club Boulevard and 10th Avenue South, with access to commercial areas. Trucks access the city via Highway 87 in the northeast, with connections to Smelter Avenue and River Drive. From the southeast, trucks enter along 10th Avenue South.

Analysis for the Great Falls Area Long Range Transportation Plan indicates that traffic congestion occurs on truck routes, including River Road North and 10th Avenue South.

RAIL

Great Falls is well-integrated into the nation's freight rail system, with numerous facilities and services. Rail facilities carry freight on lines northeast of the city and along the east side of the Missouri River, crossing the river south of downtown. The rail lines connect to the BNSF rail yard just west of the river. Rail lines extend south and northwest from the rail yard. Great Falls is located on the 100-mile BNSF main line that links Shelby and Great Falls, known as "The Great Falls Subdivision". Shelby is also located along "The Hi-Line Subdivision", a BNSF main line that runs east-west. Shelby has advocated for a freight intermodal facility to support nearby goods movement routes. The rail facilities in Shelby also serve an Amtrak passenger rail station on the Empire Builder Route (Chicago to Portland/Seattle).[11]

Rail spurs connect the rail network to several industrial facilities in the Great Falls Area, providing direct access to major goods movement facilities. **Figure 2.5** illustrates the rail lines serving the Great Falls Area. A circuitous railroad spur deviates from the area near the AgriTech Industrial Park, crosses the Missouri River just west of Rainbow Dam, and circles north and west to the Malting Plant. This spur line is located outside the City of Great Falls but supports significant goods movement activity in and through the area. The City plans to construct a rail spur to serve the AgriTech Industrial Park, generally located

[10] City Code 10.57.020.

[11] MDT. (2010). *2010 Montana State Rail Plan: Final Report.*

north of 18th Avenue North and west of 57th Street North. This facility will be designed and constructed if and when industrial development occurs in the area.

AIR

The Great Falls International Airport offers substantial infrastructure for the air cargo industry. The airport's primary runway is 10,502 feet long; the secondary runway is 6,030 feet long. The airport operates a control tower and four terminal gates. The airport occupies just over 2,100 acres and has a 531,000-square foot cargo apron area, and 72,000 square feet of cargo warehouse space. FedEx uses the warehouse space as a sorting and distribution hub for Montana. The airport operates a foreign trade zone that offers tax-free purchases to international customers. The U.S. Customs Border Patrol operates an office on the airport, which facilitates international travel.

The airport's primary runway is adequate to accommodate the mid-size cargo jets such as the B-757 operated by FedEx for interstate shipments, given typical weather and operating conditions. **Figure 2.6** illustrates the FedEx Express and UPS air cargo route network for the western United States and Canada. The majority of air cargo routes from the airport, like many in Montana, are "long-thin" routes that cover long distances with consistently low volume of cargo.

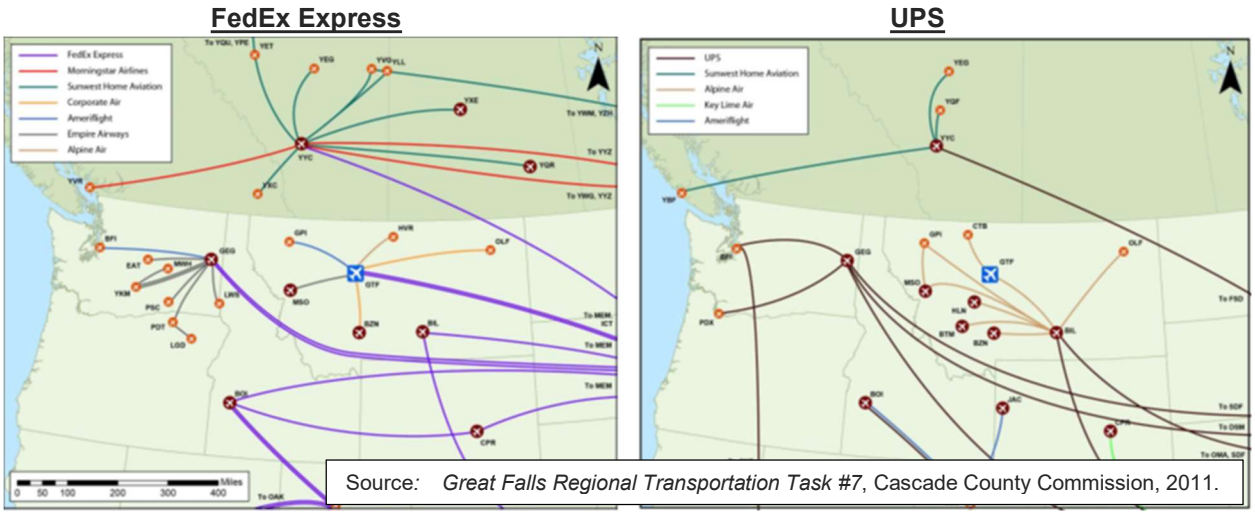


Figure 2.6: FedEx Express and UPS Air Cargo Networks in Western U.S. and Canada

2.3. FUTURE GOODS MOVEMENT SYSTEM

The Great Falls Area is planning for continued population, employment, and overall economic growth. A strong goods movement network will support economic growth by maintaining capacity, safety, and security of the transportation system, and preserve quality of life for local businesses and residents.

Production and consumption will increase along with population increases in the Great Falls Area. Population and economic projections across the state suggest that the proportional share of goods shipped by truck, rail and intermodal service are likely to remain the same as they are today, even as demand for goods movement increases. This means that higher-value finished goods produced and consumed in Montana will continue to rely on trucks to distribute goods between dispersed origins and destinations. Rail is expected to continue its primary role in shipping most of the outbound goods by weight.

Tons of goods shipped in Montana are forecasted to increase by 101 percent to 216.8 million tons by year 2035. Truck shipments will continue to account for the largest share of in-state goods movement by

weight, while rail will continue to account for nearly all of the outbound shipments by weight. **Table 2.3** shows the forecasted change in shipments by weight by 2035, with truck shipments showing the greatest growth, at 156 percent.

Table 2.3: Montana Forecast Change in Shipments by Weight (2002 to 2035, Millions of Tons)

Mode	Total Growth 2002-2035	Percent Change
Truck	82	156%
Rail	25	47%
Air	0	33%
Intermodal	2	150%
Water	-	0%
Total	109	101%

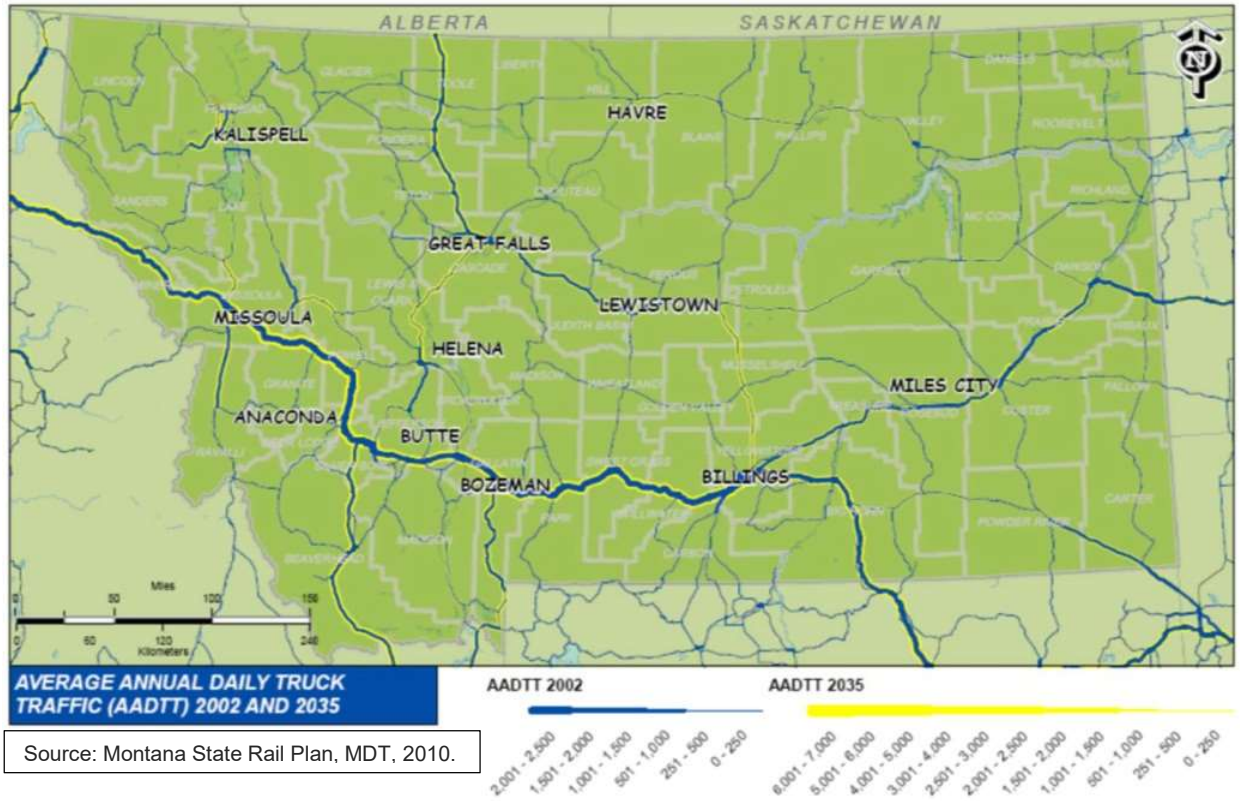
Source: Montana State Rail Plan, MDT, 2010. Does not include pipeline and intermodal shipments.

Forecasts of truck traffic show growing truck volumes by the year 2035 in the Great Falls Area. **Figure 2.7** shows the average annual daily truck traffic (AADTT) in Montana. Highways in the Great Falls Area – in particular on routes I-15 and US 87 – have lower AADTT overall than Montana's east-west Interstate routes, as shown in **Figure 2.7**. The forecasts show growth on routes connecting the region to Alberta, Canada, and to Helena and I-90.

Truck traffic is expected to increase locally due to expected increases in truck-dependent industrial manufacturing, supported by infrastructure improvements to support these industrial sectors. Expected areas of increased truck traffic include the following areas:

- *River Drive North and 57th Street North (i.e. NE Bypass)*. A new industrial park, Agri-Tech Park, opened in 2016 and will continue to be developed north of Malmstrom AFB. Developments in the area include Pacific Steel & Recycling, FedEx Ground, Montana Specialty Mills, and Helena Chemical. Future phases are being developed now are expected to serve firms reliant on goods movement by truck.
- *River Drive North and 38th Street North*. Montana Egg is planning to open a new agricultural processing facility in northeast Great Falls. Products will be shipped throughout Montana and eastern Washington mainly by truck.
- *US 87, 3rd Street Northwest, and NW Bypass*. Steel production at the ADF site will increase as the firm fabricates up 25,000 tons of steel modules for oil and gas sites in Alberta and eastern Montana, to be delivered by truck. The new industrial complex is located on land on the east side of US 87 and north of Black Eagle. The Great Falls Development Authority is currently planning increase road access to the area in order to spur further development. This would allow for safer and more efficient truck traffic in and out of the area.
- *River Drive North and 18th Avenue North*. Plans for a new industrial park with mixed use possibilities, much like the Agri-Tech Park, are currently underway. Construction of a rail spur is also planned at this site.
- *U.S. Highway 89/200*. Potential for a "food park" is under consideration in Cascade County, just east of the LRTP study area boundary. The complex would include meat packing elements, as well as milk processing facilities and production of grain for various products. A fully functioning site like this would generate upwards of 165 truck arrivals and departures weekly.
- *Vaughn Road near the planned Emerson Junction*. This planned highway interchange is located near vacant land zoned for industrial uses. The interchange could incentivize future industrial uses and lead to increased truck traffic to and from the area.

- *Airport Interchange*. The somewhat recent addition of two truck stops and I-State Truck Center to the area has led to increased truck access and egress. Truck-dependent uses may increase along Tri-Hill Frontage Road and on Ulm-Vaughn Frontage Road, increasing heavy truck use in this corridor.



Source: Montana State Rail Plan, MDT, 2010.

Figure 2.7: Average Annual Daily Truck Traffic (2002 and 2035)

2.4. Conclusion

The Great Falls Area is expected to experience an increase in goods movement as the population and employment grows across the region and the state. A strong goods movement system can facilitate and enhance economic growth by providing low cost, efficient transportation options that also protect the quality of life that is crucial to the region. A more efficient, more accessible freight network can encourage and support the economic growth that the region projects.

Important issues to address in long range planning emerge from this assessment of the goods movement transportation system, including reducing traffic congestion, preserving quality of life, balancing land uses, and creating a safe multimodal transportation network.

- **Reducing traffic congestion.** Trucks make up a relatively small share of overall traffic in the Great Falls Area. However, trucks contend with – and contribute to – traffic congestion. Transportation modeling results indicate that traffic will become severely congested on currently congested routes, and become congested on routes that are nearing congested today. Congested roadway routes will hamper economic growth by reducing efficiency of goods movement. Less efficient goods movement can result in higher prices for local goods, which reduces the economic competitiveness of the region, deters future businesses relocations in the region, and increases out-of-pocket costs for residents.

- **Preserving quality of life.** Quality of life issues related to goods movement include vehicle and loading noise, air quality, and traffic safety. Goods movement directly affects these issues due to interactions with land uses, and interactions with other users of the transportation system. It is essential for trucks to access local markets by using local streets, while through-bound truck traffic is required to use official truck routes. Unfortunately, the volume of truck traffic on local streets is negatively affecting quality of life, as reported by residents and officials in previous regional plans.

- **Balancing land use.** The City of Great Falls, Cascade County, and regional economic development organizations are advocating for continued growth in the regional economy by attracting commercial businesses, industrial businesses, and residents. As the region grows, conflicts may arise between incompatible land uses. In addition, conflict may arise between users of the transportation system. 10th Avenue South is an official truck route along a busy commercial district, with nearby access to Benefis Hospital and the University of Great Falls. The area may need to mitigate transportation congestion and safety on the corridor. Adequate planning can facilitate growth that preserves quality of life while allowing local businesses and industries the ability to efficiently move goods into and out of the region.

- **Providing convenient truck and rail access to heavy industry.** Approximately 21% of jobs in the City of Great Falls are associated with heavy industry. Continued growth is expected in these sectors, which include agriculture and oil and gas extraction and refining. These industries are dependent upon the movement of goods such as extraction materials and equipment, grains, aerospace, and wind energy equipment. Accessibility to the Interstate and rail systems is critical for these industries and their daily processes. The City of Great Falls and surrounding region can help support the growth of these industries by providing efficient truck routes and easy access to the Interstate and freight rail systems.

- **Creating a safe multimodal transportation network.** The Great Falls Area has a well-maintained transportation network that serves personal vehicles, trucks, public transit, pedestrians, and cyclists. Preserving multimodal access will be important as demands for transportation, and in particular goods movement, grow. The region should be particularly mindful of balancing transportation needs in downtown areas where major motorized transportation routes intersect with people walking to school, riding bikes, or accessing public transit.

3.0 TRANSPORTATION SECURITY

The Great Falls Area is exposed to many hazards, all of which have the potential to disrupt the community and cause damage. Hazards include a range of human and environmental incidents or events with varying probabilities of occurring and severity of effects. Hazards may threaten the security of the regional transportation system. The transportation system is also a valuable asset in mitigating and responding to emergencies.

The Department of Transportation defines security as the "…freedom from intentional harm and tampering that affects both motorized and non-motorized travelers, and may also include natural disasters."[12] Federal, state, and local agencies, and their private partners work together to create plans and policies to maintain a secure regional transportation system. These organizations coordinate to ensure that the transportation system is available as a resource to respond to emergencies in the region.

[12] http://www.planning.dot.gov/documents/BriefingBook/BBook.htm#13BB

The following sections describe the security issues relevant to the Great Falls Area transportation system, and how the LRTP helps preserve and enhance transportation security.

This section answers the following questions:

- What plans and policies are in place to guide the Great Falls Area in the event of an attack, emergency, or natural disaster?
- Who is responsible for the transportation system security and what are their roles and responsibilities?
- How does the LRTP support a secure transportation system for the community?
- What barriers to a secure transportation system exist, and what general strategies could be used to enhance the community's general emergency preparedness?

Consultations with emergency planning staff at the City of Great Falls, Cascade County, and Malmstrom AFB were held in October 2013 in preparation of the 2014 LRTP. Those consultations guided and augmented the information available from public documents. The information is updated for the 2018 LRTP where new documents are available. Contact information for the various emergency managers who serve the Great Falls Area is provided in **Table 3.1**.

Table 3.1: Security Consultation Contact Information

Name	Job Title	Organization	Phone or Email
John Stevens	Emergency Manager	Cascade County Disaster and Emergency Services	406-454-6900 jstevens@cascadecountymt.gov
Dave Nordel	Emergency Manager	City of Great Falls	406-455-8579
Brian Wilkinson	Emergency Manager	Malmstrom AFB	406-731-6695

3.1. Plans and Policies

Montana's political subdivisions have the primary responsibility for emergency operations and manage all available resources to save lives and minimize property damage. Local plans and policies[13] are critical to informing this responsibility. Security and emergency plans guide government and private organizations to ensure efforts are coordinated and comprehensive. A range of different types of plans address different levels of the transportation system in the Great Falls Area and are presented in **Table 3.2**. The plans are organized alphabetically by agency type (federal, state, local). Some plans, such as the Fixing America's Surface Transportation (FAST) Act, identify available security resources and mandate actions required by state and local government agencies. Others, such as the Cascade County Pre-Disaster Management (PDM) Plan outline planning and response procedures for local organizations.

Table 3.2: Plans, Policies and Guidelines for Transportation Security

Document (Year written)	Agency Type (Name)	Description and provisions
Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (2005)	Federal	Prior federal surface transportation funding authorization. Emphasized transportation system security by creating security planning factor. Also mandated that states address security in long-range transportation plans.

[13] Policies generally provide guidance to organizations preparing emergency and security plans. Plans generally define specific procedures and areas of authority. Plans and policies are referred to as "plans" in the remainder of this memo for convenience.

Document (Year written)	Agency Type (Name)	Description and provisions
TranPlan 21 (2002, amended in 2007)	State (MDT)	Montana's long-range transportation plan was amended in 2007 after SAFETEA-LU was passed. Key changes included creating security section, and adding security-related goals, priorities, projects, and policies.
Implementing the Recommendations of the 9/11 Commission (IRC) Act of 2007[1]	Federal	Identifies the Department of Homeland Security (DHS) as responsible agency for national rail security planning, hazardous materials, and information sharing.
Moving Ahead for Progress in the 21st Century (MAP-21) (2012)	Federal	Prior federal surface transportation funding authorization. Requires states to develop a risk-based asset management plan for the National Highway System to improve or preserve the condition of the assets and the performance of the system.[14] At least 1 percent of Section 5307 funding (Urbanized Area Formula Grants) must be used on security projects unless the recipient determines such expenditures are unnecessary. Establishes Public Transportation Emergency Relief Program that provides grants to fund capital projects and operating costs related to damage resulting from an emergency.
Fixing America's Surface Transportation (FAST) Act (2015)	Federal	Federal surface transportation funding authorization. Requires strategies to reduce the vulnerability of existing transportation infrastructure to natural disasters. Continues MAP-21 Emergency Relief Program which provides funds for emergency repairs for road damage that occurs as a result of natural disasters.
TranPlanMT (2017)	State (MDT)	Montana's current long-range transportation plan which reflects the provisions of the FAST Act. Includes discussion of efforts used to quickly and effectively respond to disasters.
National Response Framework (NRF)[15]	Federal	Provides guidelines to state and local governments to create security and emergency management plans. Guided by the National Preparedness Goal: "A secure and resilient nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk."
Montana Emergency Response Framework (2012)	State (Montana Disaster and Emergency Services)	Identifies state's roles and actions in the event of an emergency and coordinates all other emergency operations plans in Montana. Emergency Support Function – Transportation explains the role of MDT in the event of an emergency. One key action is to request support from other agencies including local agencies such as Cascade County Disaster and Emergency Services.
Cascade County Pre-Disaster Mitigation Plan (2011)	Local (Cascade County Disaster and Emergency Services)	Provides hazards analysis of the County as well as "annexes" for specific event types such as mass casualties and other events. The plan addresses security in the cities of Great Falls, Belt, Cascade, and Neihart as well as all unincorporated parts of the county.

[14] 23 U.S.C. 119(e)(1), MAP-21 § 1106.

[15] Federal Emergency Management Agency. Accessed January 2018 at http://www.fema.gov/national-planning-frameworks.

The *Cascade County PDM Plan* is the security plan for the Great Falls Area. The plan applies to and incorporates security activities from all jurisdictions in Cascade County, including Great Falls, Belt, Cascade, and Neihart. The PDM Plan integrates with plans from federal and state levels of government, including the *Cascade County Emergency Operations Plan*. It identifies agencies and staff that have authority to manage security activities, and outlines procedures for implementing the activities. The PDM Plan is designed to address six hazard mitigation objectives, including:

1. Prevention;
2. Property Protection;
3. Public Education and Awareness;
4. Natural Resource Protection;
5. Structural Projects; and
6. Emergency Services.

The PDM identifies 15 potential hazards facing Cascade County and the municipalities. The County identified the hazards based historic events, available GIS data, public input, expert opinions, and past disaster declarations. **Table 3.3** presents the hazards, including their probability of occurrence, other related hazards, and a description of the primary risk factors. Two hazards stem directly from the transportation system, including hazardous material incidents and transportation accidents. The transportation system is also critical to facilitating response efforts of nearly every identified hazard.

The LRTP considers these hazards in planning for transportation projects and programs, to ensure that local agencies have the capability to maintain transportation security and respond to potential events. The Cascade County Local Emergency Planning Committee periodically reviews the PDM Plan, and holds annual hearings to consider updates.

Table 3.3: Potential Hazards

Hazard	Occurrence Probability	Magnitude and/or Severity	Warning Time	Duration
Communicable Disease/Pandemic	Highly Likely	Catastrophic	12-24 hours	> 1 week
Wildfires	Highly Likely	Critical	< 6 hours	< 1 week
Structure Fire	Highly Likely	Critical	< 6 hours	< 6 hours
Severe Summer Weather (Thunderstorms, Wind, Hail, Tornadoes, Microbursts)	Highly Likely	Limited	< 6 hours	< 6 hours
Hazardous Material Incidents	Likely	Critical	< 6 hours	< 24 hours
Transportation Accidents (air, land, rail)	Likely	Critical	< 6 hours	< 6 hours
Severe Winter Weather	Highly Likely	Limited	> 24 hours	< 1 week
Flooding/Flash Flooding/Levee Failure	Likely	Limited	> 24 hours	> 1 week
Drought	Likely	Limited	> 24 hours	> 1 week
Volcanic Ash	Possible	Catastrophic	12-24 hours	> 1 week
Dam Failure	Possible	Catastrophic	> 24 hours	< 1 week
Landslides/Mudslides	Possible	Limited	< 6 hours	< 6 hours
Terrorism/Violence	Possible	Limited	< 6 hours	< 6 hours
Earthquake	Possible	Negligible	< 6 hours	< 24 hours

Source: Cascade County Pre-Disaster Management Plan, Cascade County, 2011.

3.2. Transportation Security Roles

The Great Falls Areas' transportation infrastructure is owned and operated by different public agencies and private organizations. These agencies and organizations coordinate with representatives of federal, state and local governments, neighboring owners/operators, and the surrounding community. Interstate 15, for example, is overseen by MDT, and passes through the City of Great Falls, affecting local traffic, quality of life, and is a key access route for personal travel, freight and emergency services. Likewise, Great Falls International Airport operates commercial flights and carries air freight and is therefore subject to federal security regulations.

Table 3.4 summarizes the agencies that play a role in ensuring a secure transportation system in the Great Falls Area. The table is organized alphabetically within the level of government. Each organization is described by its type (federal, state, or local), its main security role or level of authority, key security-related programs or departments, and the transportation modes addressed.

Table 3.4: Transportation Agencies and Security-Related Roles

Organization or Agency	Type	Security Role or Authority	Key Programs, Departments	Transportation Modes
Customs and Border Protection (CBP)	Federal	Detect, apprehend, and deter terrorists and weapons from crossing international borders. Prevent and detect smuggling across international borders. Department under the U.S. DHS.	Customs and Trade Security	• Air passenger • Freight (air, truck, rail) • Passenger Rail • Highways • Transit • Marine
Federal Emergency Management Agency (FEMA)	Federal	Provide support to first responders and citizens in preparation for and response to all hazards. Assist government agencies (local, state, tribal, etc.) and private sector in managing transportation systems during threats (ESF #1). Department under the U.S. DHS.	Emergency Support Function #1 (ESF #1)-Transportation	All modes
Federal Motor Carrier Safety Administration (FMCSA)	Federal	Regulates United States trucking industry. Enhance safety of truck drivers and commercial motor vehicles.	N/A	Truck Freight
Federal Railroad Administration	Federal	Regulates railroad safety. Promotes compliance in hazardous materials among other areas. Investigates accidents. Develops and implements safety standards. Conducts railroad safety and customer training.	N/A	
Transportation Security Administration (TSA)	Federal	Responsible for security of U.S. transportation systems. Focus on airport security, but also plays many other roles. Conducts nationwide risk assessment of a terrorist attack on the freight railroad system.[16] Included in DHS.	HAZMAT Endorsement, Threat Assessment Program. Air Cargo Screening, Federal Air Marshal training and employment	• Air passenger • Freight (air, truck, rail) • Passenger Rail • Highways • Transit • Marine
U.S. Coast Guard	Federal	Ensure security in inland waterways.		Marine
Montana Department of Disaster and Emergency Services (DES)	State	Coordinate emergency management plans and policies in Montana.		All modes

[16] The IRC required that the TSA and other federal agencies conduct a risk assessment of a terrorist attack on railroad carriers and create a national strategy for railroad transportation security.

Organization or Agency	Type	Security Role or Authority	Key Programs, Departments	Transportation Modes
Montana Department of Transportation	State	Plan for and provide traveler safety on state transportation facilities.		• Highways • Passenger Rail • General Aviation
Cascade County Disaster and Emergency Services	Local	Plan for natural disasters and other emergencies. Coordinate with cities within Cascade County.	Office of Emergency Manager	All modes
City of Great Falls	Local	Coordinate with State of Montana, Cascade County, city residents and other stakeholders to prepare for and respond to emergencies.	Mayor's Office; Office of Emergency Management Planner	All modes

*Source: Websites and other public documents, accessed September 2013. Information was supplemented through consultation with staff presented in **Table 3.1**.*

The PDM Plan identifies responsibilities for agencies and officials at Cascade County, and departments or officials in the cities of Great Falls, Belt, Cascade, and Neihart. It identifies local support organizations relevant to transportation security in the event of an emergency. For example, the Public Works departments have specific roles related to regional transportation security. Key transportation responsibilities identified in the PDM Plan include:

- Public Works
  - Identify locations where culverts are needed and install/resize as needed.
  - Consider enhanced snow removal services to support public safety and infrastructure protection.
  - Work with railroads to increase number of crossing gates.
  - Work with utility companies to bury power lines where interruption of service is frequent.

3.3. Coordination

Cascade County and local jurisdictions periodically review emergency and security planning to share local knowledge, update hazard assessments and enhance interagency coordination. In the Great Falls Area, Cascade County and the local jurisdictions jointly plan for and closely coordinate on regional security issues. The Cascade County Emergency Manager works closely with the City of Great Falls Emergency Management Planner. FEMA funds support emergency planning activities in the Great Falls Area.

Malmstrom AFB regularly transports goods using local roads and the Great Falls International Airport. Therefore, regional transportation security is critical to its mission. Malmstrom AFB and the Montana Air National Guard representatives coordinate security planning and response with local governments. Malmstrom AFB assists local governments with security planning and response as needed.

Coordination activities between regional agencies have resulted in, and are guided by, formal agreements to support security-related planning. **Table 3.5** presents these agreements, organized by the agreement type, the jurisdictions involved, and a brief description of the agreement.

Table 3.5: Security-Related Agreements

Agreement Type	Jurisdictions Involved	Description
Formal Agreement	City of Great Falls, Malmstrom AFB	Standing mutual aid agreement to help one another in the event of fire or incidents involving hazardous materials.
Formal Agreement	City of Great Falls Fire Department leads the team; Malmstrom AFB contributes labor and capabilities	Great Falls Regional HazMat Team – Codified in state law; team provides help in form of phone consultation and outreach, dispatch of partial or entire team, public outreach events including HazMat training classes or exercises.
Informal Agreement	City of Great Falls Police Department and Malmstrom AFB	Extreme weather events – In the event of flooding, high winds, severe winter events, or other natural disasters, these two entities agree to assist the other as needed.

Source: Malmstrom AFB, 2013.

3.4. Barriers

The Great Falls Area has an extensive transportation network. This network is strengthened by various infrastructure components that support the basic operation of the transportation system. For the purposes of the LRTP update process, stakeholders and the public were asked during various outreach activities to provide input as to what they perceived were the critical infrastructure and key resources essential to emergency preparedness and overall quality of life of the area's citizens and to its economic vitality. The key components identified during the LRTP outreach process include the following assets:

- Interstate Systems (I-15, I-315)
- U.S. Highways (e.g. U.S. 87, U.S. 89)
- Bridges (10th Ave S, Central Ave W, 10th St N, 15th St N)
- Principal Arterial Roadways (10th Ave S, 3rd St NW, NW Bypass, 14th / 15th St Couplet, 9th St, 57th St, River Dr N)
- Malmstrom Air Force Base
- Great Falls International Airport
- Freight Activity Centers
- Rail Networks
- Pipeline Network
- Great Falls Transit System

Of the assets presented, perhaps most striking is the presence of four bridges crossing the Missouri River. These bridges may act as pinch-points during times of emergency response. Depending on the type and location of an event, routing from one bridge to another may delay emergency response and provide excessive delay. Low lying roadways within or adjacent to the Missouri River floodplain may also present various concerns.

3.5. General Strategies to Enhance Security

As agencies charged with security develop new and expand existing emergency response plans, and as surface transportation system operators begin to look at security, the following recommendations should be considered:

- Large scale events should have evacuation plans. Inclusion of such plans should be encouraged in such event planning, with the following considerations:
    - coordinated signals during the evacuation.

    - identified evacuation routes away from "high-risk areas" or key transportation facilities. Examples may include the petroleum refinery, major bridges, rivers, Malmstrom Air Force Base, Great Falls International Airport and Air National Guard, etc.
    - Detour plans and other alternate routes should also be generally identified.
    - Long-term detours in the event of a major failure (i.e., bridge collapse) or catastrophic event (i.e., destructive flood) should also be identified.
    - Coordination with Cascade County for those areas surrounding the City Limits. Such areas could include the west side near the Sun River; Fox Farm Road area south of the City; Gibson Flats; Black Eagle; County lands between the City and Malmstrom Air Force Base; etc.)
- As owners of the local transportation system (such as BNSF Railroad, MDT, City of Great Falls and Cascade County) identify specific structures, facilities or other elements of the transportation system that are at high risk of attack, steps should be taken in a timely manner to make them secure.
- Any security measures contemplated for implementation should take into full account the privacy of the transportation user and make every attempt to preserve their privacy, while still providing a safe, secure transportation system.

The above recommendations should be forwarded to the appropriate implementing agencies for consideration.

3.6. Conclusion

Coordination between the City of Great Falls, Cascade County, local partners, and federal and state agencies is critical to maintain transportation system security. Coordination is also important to ensure the regional transportation system supports emergency planning for a range of potential hazards.

The Great Falls Area LRTP incorporates information from security plans – in particular the PDM Plan – and contributes to security planning by comprehensively assessing the regional transportation system. Specific elements of transportation planning that contribute to transportation security include:

- Coordinate with Cascade County and local partners to inform and update the PDM Plan through activities such as data sharing and asset inventory.
- Inventory of the Area's major transportation assets and potential hazards. This includes bridges, roadways, Great Falls International Airport, freight rail, public transportation vehicles and routes, and pedestrian facilities.
- Coordinate with the Great Falls Transit Agency to manage public transportation assets.
- Assess improvements needed and identify resources to maintain critical transportation assets.
- Designate goods movement routes, particularly routes for hazardous materials transport.

APPENDIX D:
Socioeconomics and Land Use Forecasting



SOCIOECONOMICS AND LAND USE FORECASTING

February 28, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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SOCIOECONOMICS AND LAND USE FORECASTING

1.0 INTRODUCTION

Local and regional population and economic characteristics have important influences on motor vehicle travel. A review of demographics for the *Great Falls Area Long Range Transportation Plan* (LRTP) is appropriate to gain an understanding of historical trends in population, age, race and ethnicity. Understanding the composition of the population is necessary, as the data may influence the types of improvements that are identified. For example, an aging population may indicate a need for specific types of transportation improvements such as transit services and/or non-motorized infrastructure improvements. Additionally, the presence of a disadvantaged population may warrant other considerations.

Likewise, existing land uses and potential land use changes have a direct influence on the transportation network and its use. For this reason, it is important to review community development patterns over time and understand where community conditions may be favorable for new residential and non-residential growth.

This memorandum discusses the background and assumptions used to project growth in the Great Falls area for the planning horizon. By using population, employment and other socioeconomic trends as aids, the future transportation requirements will be defined. For the LRTP, the study area includes all lands within the City of Great Falls, Malmstrom Air Force Base (AFB), the unincorporated community of Black Eagle, Great Falls International Airport, and adjacent lands in Cascade County where suburban development has occurred or may occur in the future.

A travel demand model of the transportation system for Cascade County was built by the Montana Department of Transportation (MDT). Information from the analysis in this memo was used to update the allocations of future residential and employment growth. The changes to the system that are projected to occur by the year 2038 were incorporated into the model to forecast the future transportation conditions.

2.0 POPULATION AND DEMOGRAPHIC TRENDS

Understanding Great Falls' population characteristics and growth trends is crucial for this long-range planning process. In order to properly accommodate for the transportation needs of current and future residents of the Great Falls Area, it is important to recognize both the number of people living in and around the study area, as well as their key demographic characteristics. This will help assure all residents have access to appropriate and efficient transportation facilities.

2.1. Historic Population Trends

Table 1 shows the total populations for Cascade County, the City of Great Falls and the Malmstrom AFB and Black Eagle Census Designated Places (CDP) according to the Census over the 1970 to 2010 period. CDPs are delineated by the Census Bureau to provide data for settled concentrations of population that are identifiable by name but are not legally incorporated. Population data is available for Malmstrom AFB over the 1970-2010 period. The Black Eagle CDP was initially created for the 2000 Census and data for earlier censuses is not available for this subdivision of Cascade County. **Table 1**

also shows the overall change in residents (shown numerically and as a percentage) for the County, the City of Great Falls, and other geographies of interest during each decade since 1970.

The table shows the total population of Cascade County has fluctuated slightly, but has generally remained near 81,000 residents over the 1970-2010 period. The City of Great Falls recorded its highest population (60,091) at the time of the 1970 Census. After two decades of decline, the City's population began to increase after 1990 and had approximately 58,500 residents in 2010. The population of Malmstrom AFB has decreased sharply every decade since 1970. By 2010, Malmstrom AFT had 5,000 fewer residents than at the time of the 1970 Census. The population of the Black Eagle CDP was approximately 900 at the time of the last two census counts.

Table 1: Historic Population Data

Area	1970	1980		1990		2000		2010	
Cascade County	**81,804**	**80,696**		**77,691**		**80,357**		**81,327**	
Net Change (%)	--	*-1,108*	*-1.4%*	*-3,005*	*-3.7%*	*2,666*	*3.4%*	*970*	*1.2%*
City of Great Falls	**60,091**	**56,725**		**55,097**		**56,690**		**58,505**	
Net Change (%)	--	*-3,366*	*-5.6%*	*-1,628*	*-2.9%*	*1,593*	*2.9%*	*1,815*	*3.2%*
Malmstrom AFB CDP	**8,374**	**6,675**		**5,938**		**4,544**		**3,472**	
Net Change (%)	--	*-1,699*	*-20.3%*	*-737*	*-11.0%*	*-1,394*	*-23.5%*	*-1,072*	*-23.6%*
Black Eagle CDP	[a]	[a]		[a]		**914**		**904**	
Net Change (%)	--	--		--		--		*-10*	*-1.1%*
State of Montana	**694,409**	**786,690**		**799,065**		**902,195**		**989,415**	
Net Change (%)	--	*92,281*	*13.3%*	*12,375*	*1.6%*	*103,130*	*12.9%*	*87,220*	*9.7%*
United States	**203,392,031**	**226,545,805**		**248,709,873**		**281,421,906**		**308,745,538**	
Net Change (%)	--	*23,153,774*	*11.4%*	*22,164,068*	*9.8%*	*32,712,033*	*13.2%*	*27,323,632*	*9.7%*

Source: US Bureau of the Census, Census of the Population
[a] No data available

Both the State of Montana and the United States (US) showed population increases during each decade between 1970 and 2010. Overall, the population of the US and State of Montana, increased by 52 percent and 42 percent, respectively over the 1970-2010 period. During the same period, the total population of Cascade County declined approximately 0.6 percent and the population of the City of Great Falls showed a 2 percent overall decline. Between 1990 and 2010, the County's population increased by 4.7 percent and the City's population grew by 4.4 percent.

Table 2 presents historical compound annual growth rates (CAGR) for population for Cascade County and the City of Great Falls and compares them with the growth rates seen for the State of Montana and the US. The population losses seen in Cascade County and the City of Great Falls during the 1970s and 1980s, coupled with the slow growth seen over the last 20 years, has resulted in long term growth rates of near zero. Positive rates of annual population growth have been recorded for both the County and City in the last 20 years. However, these annual growth rates are well below those seen for the state and nation.

Table 2: Historic Compound Annual Growth Rates

Area	Last 40 Years (1970 - 2010)	Last 20 Years (1990 - 2010)	Last 10 Years (2000 - 2010)
Cascade County	-0.01%	0.23%	0.12%
City of Great Falls	-0.07%	0.30%	0.32%
State of Montana	0.89%	1.07%	0.93%
United States	1.05%	1.09%	0.93%

2.2. Population Changes Since 2010

The Census Bureau releases population estimates each year for various geographies to update information collected in the most recent census. Each new series of data incorporates the latest administrative record data, geographic boundaries, and methodology to provide annual revisions to the decennial census. **Table 3** shows the US Census Bureau estimates of current (2016) populations for Cascade County, the City of Great Falls, the State of Montana, and the nation. These estimates show that populations in the County and City are continuing to increase at rates greater than those seen during the last two decades, but less than those seen in the last decade. The rate of growth continues to lag that seen for the state and nation.

Table 3: Population Changes Since 2010

Area	2010 Census	2014 Estimate	2015 Estimate	2016 Estimate	Annual % Change (2010-2016)
Cascade County	81,327	82,236	82,118	81,755	0.09%
City of Great Falls	58,505	59,562	59,584	59,178	0.19%
State of Montana	989,415	1,022,867	1,032,073	1,042,520	0.88%
United States	308,745,538	318,563,456	320,896,618	323,127,513	0.76%

Source: US Bureau of the Census, Current Estimates Data, available at http://www.census.gov/popest/data/index.html

2.3. Race and Ethnicity

Table 4 depicts the race and ethnicity characteristics in Cascade County, the City of Great Falls, and within the Malmstrom AFB and Black Eagle CDPs based on the American Community Survey (ACS) Profile Report for the 2012-2016 period for these selected geographies. Similar statistics are provided for the State of Montana and the United States for comparison purposes. The ACS data are period estimates meaning they represent the characteristics of the population and housing over a specific data collection period (in this case 5 years). For this reason, the total populations shown differ from those recorded during the 2010 Census. The percentages listed for ethnic groups presented in the table may not match the Census total percentages and percentages may not add up to 100 percent.

Table 4: Population Race and Ethnicity Data (2012-2016)

Subject	City of Great Falls	Cascade County	Malmstrom AFB CDP	Black Eagle CDP	State of Montana	United States
White	87.70%	88.80%	78.70%	91.80%	89.10%	73.30%
Black or African American	0.80%	1.20%	11.80%	0.00%	0.40%	12.60%
American Indian and Alaska Native	5.40%	4.50%	0.40%	5.90%	6.60%	0.80%
Asian	1.10%	0.90%	1.20%	0.00%	0.70%	5.20%
Native Hawaiian and Other Pacific Islander	0.10%	0.10%	0.20%	0.00%	0.10%	0.20%
Some Other Race	0.60%	0.70%	4.90%	0.00%	0.50%	4.80%
Two or More Races	4.30%	3.90%	2.90%	2.30%	2.60%	3.10%
Hispanic or Latino (of any race)	4.10%	4.10%	16.90%	0.00%	3.40%	17.30%
Total Population	**59,479**	**82,049**	**3,933**	**1,022**	**1,023,391**	**318,558,176**

Source: US Bureau of the Census, American Community Survey (ACS) Profile Report 2012-2016 Estimates, available at http://mcdc1.missouri.edu/acsprofiles/acsprofilemenu.html

The populations of Cascade County and the City are predominately white with percentages of minority populations generally similar to those seen for the State of Montana. The racial and ethnic composition of the Malmstrom AFB and Black Eagle CDPs varies somewhat from that of Cascade County and City of Great Falls. These CDPs have populations with higher percentages of some minority groups.

2.4. Age Distribution

Table 5 depicts the change in total population and age composition for Cascade County and the City of Great Falls since 1980. Three age categories (residents less than 18 years old, residents 18 to 64 years old, and residents over age 65) were considered in the analysis of age distribution.

Table 5: Age Distribution (1980 to 2010)

Year	Cascade County				City of Great Falls			
	<18 Years	18-64 Years	65+ Years	Median Age	<18 Years	18-64 Years	65+ Years	Median Age
1980	23,544	49,164	7,988	28.6	15,713	34,489	6,523	30.6
1990	21,520	46,304	9,867	32.7	14,325	32,507	8,265	34.4
2000	20,912	48,197	11,248	36.7	14,138	33,654	8,898	37.8
2010	18,630	50,007	12,690	38.9	13,161	35,648	9,696	39.0
Change (1980-2010)	**-4,914**	**843**	**4,702**	**10.3**	**-2,552**	**1,159**	**3,173**	**8.4**
	-20.9%	***1.7%***	***58.9%***	***36.0%***	***-16.2%***	***3.4%***	***48.6%***	***27.5%***

Source: US Bureau of the Census, Census of the Population

As discussed earlier, the County's population showed only a slight net increase in residents between 1980 and 2010 and the City's population increased by about 3.1 percent over the same period. Between 1980 and 2010, the share of County residents in the "less than 18 years old" category has decreased by nearly 21 percent, while the number of residents in "65 years and over" category increased by nearly 59 percent. During the same time period, the number of City residents in the "less than 18 years old" category decreased by about 16 percent, while the number of residents in "65 years and over" category increased by nearly 49 percent. The median ages of both County and City residents showed notable increases between 1980 and 2010. The median ages of County and City residents were 38.9 years and

39.0 years, respectively, at the time of the 2010 Census. These statistics point to the aging of the population, and corresponds to similar trends within Montana and the United States.

To examine more specifically how age groups have changed in Cascade County, age group data from the 2000 Census and 2010 Census were reviewed for the County and the City of Great Falls. This review showed the following changes:

- Notable (12-23 percent) declines in the population between 5 to 17 years;
- Declines of nearly 30 percent in the 35- to 44-year old population;
- The share of the population between 55 and 64 years increased by 30-50 percent; and
- The population over the age of 65 (including the share of residents over age 85) grew substantially.

2.5. Disability Status

The 2012-2016 ACS 5-Year Estimate for Cascade County and the City of Great Falls was reviewed to obtain information about the number of residents with disabilities (which include hearing or vision difficulties, cognitive difficulties, and ambulatory difficulties). This information is important to review since segments of the population with disabilities may require special accommodations for transport or unique considerations in the design of transportation infrastructure.

The ACS data for the 2012-2016 period showed that approximately 15 percent of the civilian non-institutionalized populations of both the County and City were considered to have one or more disabilities. The City of Great Falls generally has a similar percentage of people with disabilities as Cascade County, however in most cases, the proportion is slightly higher in the City than the County. The data indicates the following for disabled residents of the County and City:

- About 4 percent of residents under the age of 18 had one or more disabilities;
- Roughly 13 percent of the residents between 18 and 64 years had one or more disabilities; and
- Approximately 39 percent of residents 65 years and older had one or more disabilities.

2.6. Personal Travel and Commuting Characteristics

According to the ACS profile for the 2012-2016 period, approximately 92 percent of residents in occupied housing units within the City of Great Falls and Cascade County had access to at least one vehicle. In comparison, residents of nearly 95 percent of all occupied housing units in Montana and 91 percent of all occupied housing units in the nation had access to one or more vehicles.

Information about the number of workers (16 years and older) and their commuting characteristics is also available from the ACS. The ACS information provided estimates of the total share of workers who commute or work at home, the transportation modes used by commuters, and the mean travel times to work for commuters. **Table 6** presents commuting characteristics for workers in Cascade County, the City of Great Falls, and the Malmstrom AFB and Black Eagle CDPs. Similar statistics for the State of Montana and the United States are provided for comparison.

Table 6: Mode of Transportation to Work (2012-2016)

Subject	City of Great Falls	Cascade County	Malmstrom AFB CDP	Black Eagle CDP	State of Montana	United States
Number of Workers 16 Years and Older	**28,186**	**38,785**	**2,239**	**450**	**483,881**	**145,861,216**
% Who Commuted to Work	97.30%	96.90%	96.70%	100.00%	93.70%	95.40%
% Who Worked at Home	2.70%	3.10%	3.30%	0.00%	6.30%	4.60%
Transportation Mode						
Drove alone, car, truck, van	82.00%	80.40%	76.70%	76.20%	75.10%	76.40%
Carpooled	10.30%	11.10%	14.70%	10.20%	10.20%	9.30%
Public Transportation (excluding taxicabs)	0.80%	0.80%	0.00%	6.90%	0.80%	5.10%
Walked to Work	3.10%	3.50%	4.70%	0.00%	5.1%	2.80%
Other means of commuting	1.10%	1.10%	0.60%	6.70%	2.40%	1.80%
Mean Travel Time to Work	**13.8 min**	**15.6 min**	**14.0 min**	**13.0 min**	**17.9 min**	**26.1 min**

Source: US Bureau of the Census, American Community Survey (ACS) Profile Report 2012-2016 Estimates, available at http://mcdc1.missouri.edu/acsprofiles/acsprofilemenu.html

The table shows that approximately 92 percent of the commuting workers in Cascade County and City of Great Falls rely on personal vehicles or carpools for transportation to work destinations. The share of workers who drove alone to work is higher that seen for the state and nation. The share of workers who walked to work or used other means to commute is also below that seen for Montana and the US. The data also indicates that public transportation options are limited for Montana residents at all geographies as compared to elsewhere in the United States. Workers in Cascade County and the City also have notably shorter commute times than elsewhere in the state or nation.

3.0 HOUSING UNITS AND HOUSEHOLDS

The Census Bureau identifies a "housing unit" as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Separate living quarters are those in which the occupants live and eat separately from any other persons in the building and which have direct access from the outside of the building or through a common hall. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements. A "household" includes all the persons who occupy a housing unit according to the Census Bureau definition. For purposes of allocating future residential growth, housing units are of interest since they are inputs to the travel demand model.

3.1. Number of Housing Units

Table 7 lists the number of housing units that existed within the various geographies of Cascade County during recent decennial censuses. Overall, the number of housing units in Cascade County increased by nearly 16 percent during the 1980-2010 period, with significant increases in the number of housing units recorded during each of the last two decades in the County. This trend is similar for the City of Great Falls which showed an 11.6 percent increase in housing units between 1980 and 2010.

Table 7: Number of Housing Units (1980-2010)

Area	1980	1990	2000	2010
Cascade County				
Population	80,696	77,691	80,357	81,327
Housing Units	32,199	33,063	35,225	37,276
Net Change	--	864	2,162	2,051
Population per Housing Unit	2.51	2.35	2.28	2.18
City of Great Falls				
Population	56,725	55,097	56,690	58,505
Housing Units	24,056	24,152	25,243	26,854
Net Change	--	96	1,091	1,611
Population per Housing Unit	2.36	2.28	2.25	2.18
Malmstrom AFB CDP				
Population	6,675	5,938	4,544	3,472
Housing Units	1,566	1,496	1,405	1,171
Net Change	--	-70	-91	-234
Population per Housing Unit	4.26	3.97	3.23	2.96
Black Eagle CDP				
Population	[a]	[a]	914	904
Housing Units	[a]	[a]	458	474
Net Change	--	--	--	16
Population per Housing Unit	--	--	1.99	1.91

Source: US Bureau of the Census, Census of the Population
[a] No data available

Several other trends are obvious from the housing unit data presented in **Table 7**:

- The County has seen an increase of more than 4,200 housing units over the last 20 years, with 64 percent of these housing units being added within the City of Great Falls.
- The number of housing units in the Malmstrom AFB CDP has decreased by nearly 25 percent over the period.

3.2. Population Per Housing Unit

The data in **Table 7** shows that the population per housing unit decreased for all geographies between 1980 and 2010. The population per housing unit in Cascade County and the City of Great Falls was identical at 2.18 persons per housing unit at the time of the 2010 Census. The population per housing unit for the State of Montana was 2.04 according to the 2010 Census.

Because not all housing units are occupied, it is interesting to consider the number of residents per occupied housing unit. At the time of the 2010 Census, more than 90 percent of the housing units in the County were occupied and more than 94 percent of those in the City of Great Falls were occupied. If only occupied housing units are considered, the resulting population per housing unit rates are 2.41 people per unit in the County and 2.31 people per unit in the City. Comparable rates for 2010 in the Malmstrom AFB and Black Eagle CDPs were determined to be 4.04 and 2.12 persons per unit, respectively.

4.0 EMPLOYMENT AND INCOME TRENDS

Cascade County is Montana's fifth most populous county, while Great Falls, the county seat, is the state's third largest city. Great Falls accounts for about 72 percent of Cascade County's total population. The city is home to Malmstrom AFB which is a driving force in the regional economy. Great Falls is also home to the C. M. Russell Museum, the Lewis & Clark Interpretive Center, Great Falls College Montana State University, and associated College of Technology.

4.1. Historic Employment in Cascade County

Employment by industry for Cascade County for milestone years between 1970 and 2015 is represented in **Table 8**. The most recent available data shows that total full and part-time employment in the county was 50,348 in 2015, 98 percent of which were non-farm related employment. Total full and part-time employment in Cascade County grew at an annual rate of approximately 0.70 percent.

The data in **Table 8** shows that between 1970 and 2015, the most notable net increases in employment occurred in the services industry, where the total number of jobs more than tripled. Other industry sectors showing sizable increases in employment since 1970 include: construction (net gain of 1,117 jobs); finance, insurance and real estate (net gain of 1,407 jobs); and state and local government (net gain of 935 jobs). Notable declines in employment were seen in the manufacturing, transportation and public utilities sector, federal and civilian government, and military. Combined, the declines in these sectors resulted in more than 5,000 fewer jobs in 2015 than in 1970.

Malmstrom AFB accounts for the majority of the military employees in Cascade County. Total full and part-time military employment in 1970 accounted for 15.5 percent of jobs in the County. Military employment in the county has steadily declined since 1970. There were 2,319 fewer military jobs in 2015 than in 1970. Total full and part-time military employment represented about 7 percent of jobs in the County in 2015. Most recently, military job losses resulted after a 2007 decision by the United States Air Force to deactivate the 564th Missile Squadron from its existing mission at Malmstrom.

Table 8: Historical Employment Trends for Cascade County (1970–2015)

Employment	1970	1980	1990	2000	2010	2015	Growth Rate (1970-2015)
Total Full/Part time Employment	**37,297**	**42,836**	**43,160**	**47,944**	**50,017**	**50,348**	**0.67%**
Farm Employment	1,328	1,039	1,036	1,209	1,114	1,153	-0.31%
Non-Farm Employment	35,969	41,797	42,124	46,735	48,903	49,195	0.70%
Employment by Industry							
Agricultural Services & Forestry	134	159	352	[a]	159	175	0.59%
Mining	55	60	66	[a]	130	205	2.97%
Construction	2,114	2,211	1,837	2,654	3,249	3,231	0.95%
Manufacturing	2,920	1,659	1,244	1,425	1,082	1,437	-1.56%
Transportation & Public Utilities	2,216	2,193	2,165	2,052	1,583	1,676	-0.62%
Wholesale Trade	1,758	3,193	2,347	1,917	1,474	1,587	-0.23%
Retail Trade	6,266	7,697	8,571	10,048	6,117	6,179	-0.03%
Finance, Insurance & Real Estate	2,785	3,804	3,119	4,042	4,875	4,192	0.91%
Services	6,497	10,264	12,000	14,736	20,581	21,345	2.68%
Federal & Civilian Government	2,315	1,773	1,780	1,532	1,858	1,643	-0.76%
Military	5,785	4,989	4,726	3,881	3,583	3,466	-1.13%
State & Local Government	3,124	3,795	3,917	3,869	4,212	4,059	0.58%

Source: US Department of Commerce Bureau of Economic Analysis – Table CA25 and Table CA25N.
[a] Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

4.2. Employment Trends by Industry

Table 9 presents data on the estimated number of civilian employees (age 16 years and older) and the industries in which they are employed in Cascade County, the City of Great Falls, and the Malmstrom AFB and Black Eagle CDPs. The data in the table, taken from 2012-2016 ACS profile, also includes employment estimates by industry. It is important to recognize that the employment numbers shown in **Table 9** do not account for military employment in the Cascade County or its various other geographic subdivisions. It is also worth noting that all ACS data are survey estimates with varying margins of error. Many of the employment numbers presented for the Malmstrom AFB and Black Eagle CDPs are considered "statistically suspect" due to their margins of error. *The Malmstrom AFB Joint Land Use Study Final Report* released in March 2012 states that total employment at the Base (excluding dependents) was 4,524, composed of 3,149 military and 1,375 civilian (appropriated, non-appropriated, contract, and private business) personnel.

The employment by industry data from the 2012-2016 ACS for the various geographies of Cascade County supports the information presented in **Table 8**. The majority of the employment in the County and City is associated with the services industry, followed by retail trade and construction industries.

A recent publication in the Great Falls Tribune (March 2016) identifies the largest civilian employers in the City and County:

- Benefis Hospital (3,107 employees)
- Great Falls Public Schools (2,048 employees)
- City of Great Falls (575 employees)
- Great Falls Clinic (541 employees)
- Cascade County (500 employees)

Table 9: Civilian Employment by Industry (2012-2016)

Subject	Cascade County		City of Great Falls		Malmstrom AFB CDP		Black Eagle CDP	
Agriculture, forestry, fishing, hunting, and mining	1,129	3.1%	486	1.8%	0	0.0%	0	0.0%
Construction	2,490	6.8%	1,813	6.6%	4	0.5%	16	3.6%
Manufacturing	1,182	3.2%	861	3.1%	6	0.8%	40	8.9%
Wholesale Trade	900	2.4%	647	2.3%	10	1.3%	0	0.0%
Retail Trade	4,700	12.8%	3,654	13.3%	71	9.1%	106	23.6%
Transportation, warehousing, and public utilities	1,945	5.3%	1,347	4.9%	11	1.4%	21	4.7%
Information	663	1.8%	563	2.0%	6	0.8%	0	0.0%
Finance and Insurance, and real estate and rental and leasing	2,472	6.7%	1,964	7.1%	44	5.7%	9	2.0%
Professional, scientific, management and administrative	2,742	7.5%	2,184	7.9%	44	5.7%	0	0.0%
Education services, health care, and social assistance	9,535	25.9%	7,346	26.7%	204	26.3%	99	22.0%
Arts, entertainment, and recreation, and accommodation, and food services	4,445	12.1%	3,494	12.7%	149	19.2%	91	20.2%
Other services, except public administration	1,925	5.2%	1,396	5.1%	4	0.5%	19	4.2%
Public administration	2,630	7.2%	1,792	6.5%	223	28.7%	49	10.9%
Total Employed Population 16 yrs and over		**36,758**		**27,547**		**776**		**450**

Source: US Bureau of the Census, American Community Survey (ACS) Profile Report 2012-2016 Estimates, available at http://mcdc1.missouri.edu/acsprofiles/acsprofilemenu.html

4.3. Unemployment Rates

Unemployment rates are represented in **Table 10** and are current as of November 2017. The data shows an unemployment rate for Cascade County equal to that for the United States and slightly lower than that for the State of Montana (3.9 versus 4.1 percent). Corresponding unemployment information for the City of Great Falls is unavailable.

Table 10: Employment Statistics (2017)

Area	Total Labor Force	Employed	Unemployed	Unemployment Rate
Cascade County	38,145	36,648	1,497	3.90%
State of Montana	523,574	502,296	21,278	4.10%
United States	160,466,000	154,180,000	6,286,000	3.90%

Source: MT Department of Labor and Industry, Research and Analysis Bureau – Labor Force Statistics, November 2017 (data is not seasonally adjusted).
[(a)] US Bureau of the Census, American Community Survey (ACS) Profile Report 2012-2016 Estimates

4.4. Income Levels

Estimates of median household income and per capita income for Cascade County, the City of Great Falls, and other geographies are available in the 2012-2016 ACS profile and are shown in **Table 11**. The ACS shows estimated median household incomes for in Cascade County and the City of Great Falls as $45,469 and $43,497, respectively. ACS median household income estimates for the Malmstrom AFB and Black Eagle CDPs were $47,500 and $ 28,179, respectively. Median household income levels for all geographies in Cascade County were below the median household income for the State of Montana

($48,380). In general, households within Cascade County earn about 6 percent less than what is earned by an average Montana household. Cascade County's median household income was about 87 percent of that estimated for the nation ($55,322). Similar relationships exist when reviewing per capita income levels in Cascade County and the City of Great Falls. The per capita income levels for all geographies in the County are below those seen for the state and nation.

Estimates of per capita personal income for 2016 are available from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA) for the nation, states, counties, and other selected geographies. Personal income is the income received by all persons from all sources. Per capita personal income is calculated as the total personal income of the residents of an area divided by the population of the area. BEA data for 2016 shows that Cascade County's estimated per capita personal income is above that for the state but below that of the nation.

Table 11: Income Levels (2012-2016)

Area	Median Household Income	Per Capita Income	2016 Per Capita Personal Income
United States	$55,322	$29,829	$49,246
State of Montana	$48,380	$27,309	$42,947
Cascade County	$45,469	$26,578	$43,375
City of Great Falls	$43,497	$26,369	--
Malmstrom AFB CDP	$47,500	$20,172	--
Black Eagle CDP	$28,179	$18,887	--

Source: US Bureau of the Census, American Community Survey (ACS) Profile Report 2012-2016 Estimates and U.S. Department of Commerce, Bureau of Economic Analysis (BEA).

4.5. Poverty Status

Table 12 presents poverty statistics for various geographies in Cascade County and comparable statistics for the State of Montana and the nation.

Table 12: Poverty Status (2012-2016)

Area	Persons Living in Poverty (%)	Persons Under 18 in Poverty (%)	Persons over 65 in Poverty (%)
United States	15.1	21.2	9.3
State of Montana	14.9	18.6	8.5
Cascade County	14.7	20.9	8.1
City of Great Falls	16.1	23.6	7.9
Malmstrom AFB CDP	3.2	3.6	0.0
Black Eagle CDP	22.4	24	35.7

Source: US Bureau of the Census, American Community Survey (ACS) Profile Report 2012-2016

According to the 2012-2016 ACS profile, the number of residents living below the poverty line was higher for the City of Great Falls than for the State and Cascade County. About 14.9 percent of all individuals living in Montana were estimated to be below the poverty line. The ACS estimates show 14.7 percent and 16.1 percent of the individuals living in Cascade County and City of Great Falls, respectively, were living in poverty.

The ACS data also shows the County and City likely had a greater percentage of persons under the age of 18 living in poverty than seen for the state and nation. However, the share of persons over the age of 65 living in poverty is likely lower than seen at the state and national level.

Note the poverty statistics shown for the Malmstrom AFB and Black Eagle CDPs are considered "statistically suspect" due to their margins of error.

5.0 EXISTING LAND USE AND DEVELOPMENT

Land use plays a critical role in shaping transportation networks. Land use decisions affect the transportation system and can increase viable options for people to access work and recreation sites, goods, services, and other resources in the community. In turn, the existing and future transportation system may be impacted by the location, type, and design of land use developments through changes in travel demands, travel mode choices, and travel patterns.

5.1. Existing Land Use and Development

The City of Great Falls was built on a grid system of streets with a defined Central Business District surrounded by residential development. Commercial and industrial uses were typically concentrated in the Central Business District or along railroad lines or major roads and streets. The community has evolved over the years as population growth and new development has been realized. Commercial development is no longer focused on the downtown area and many retail functions have shifted to outlying shopping centers and commercial areas, like those along Tenth Avenue South and Third Street Northwest. Today, downtown Great Falls is the governmental and financial center of the community and houses many professional offices and specialty retail stores.

Extensive residential uses are still seen in the areas around the central City. However, the residential development pattern has extended to the fringe areas surrounding the City and is characterized by low-density residential development on lots of one to ten acres. Multiple family residential development is widely scattered throughout the community. Most new housing development in the Great Falls area has occurred to the southwest, southeast, and north of the city.

The City's current Growth Policy indicates "increased reliance on trucking has allowed manufacturers and other types of industries to locate wherever land is available with good access, adequate utilities, and proper zoning." It is no longer necessary for industrial land uses to be located near railroad lines. As a result, few substantial concentrations of new industrial development occur within the city proper. However, concentrations do occur in the North Park industrial subdivision and near the Great Falls International Airport.

Figure 1 illustrates current land uses in the City of Great Falls. A breakdown of current land uses by type is also provided for reference in **Table 13**.

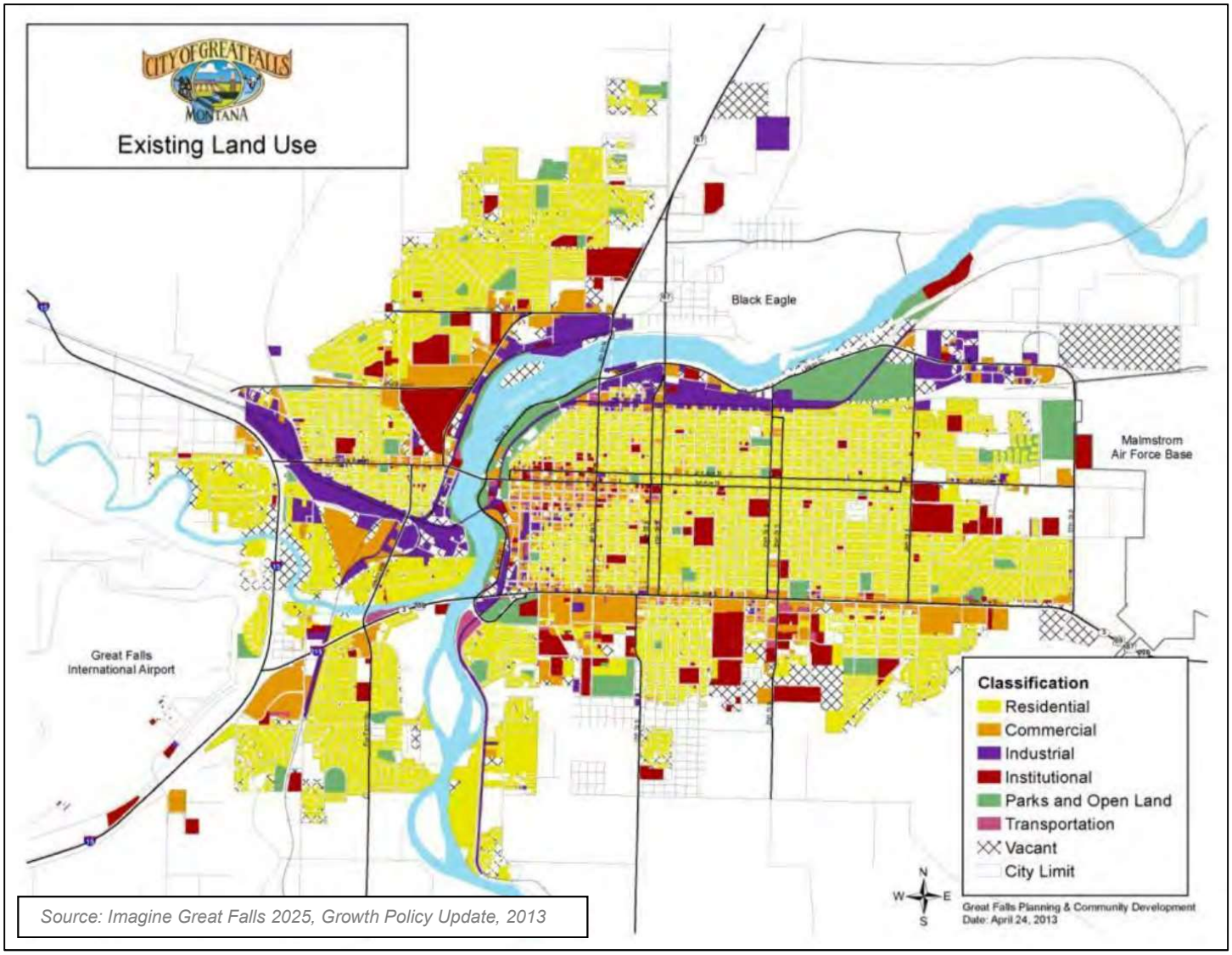


Figure 1: Existing Land Use

Table 13: Existing Land Uses (2012)

Classification	Uses	Acres	Percent
Residential	Single, multifamily, mobile home, retirement	4,318	39%
Commercial	Retail, shopping center, FIRE, Hotel/Motel, Commercial with residential, child care	1,004	9%
Industrial	Light and heavy	1,276	12%
Institutional	Government, education, church, semi public	2,114	19%
Open Land	Green space	731	7%
Transportation	Public, private parking, ROW, RR and utilities	91	1%
Vacant	Commercial and residential	1,534	14%
Total		**11,068**	

Source: Imagine Great Falls 2025, Growth Policy Update, 2013

5.2. Recent Development Trends and Future Growth Areas

A map showing how the land area of the City of Great Falls has expanded between 1962 and 2012 is presented in **Figure 2**. The incorporated area of the City has increased by more about 9.3 square miles over the past 50 years and now encompasses more than 22.5 square miles of land. As **Figure 2** shows, the city has grown around most of its periphery. Notable areas where expansion has occurred include along the southern of expansion exist along the southern perimeter of the city and to the southwest near Great Falls International Airport. Infill development has occurred to the east between the city and Malmstrom AFB and north of the Missouri River along US Highway 87 and Black Eagle.

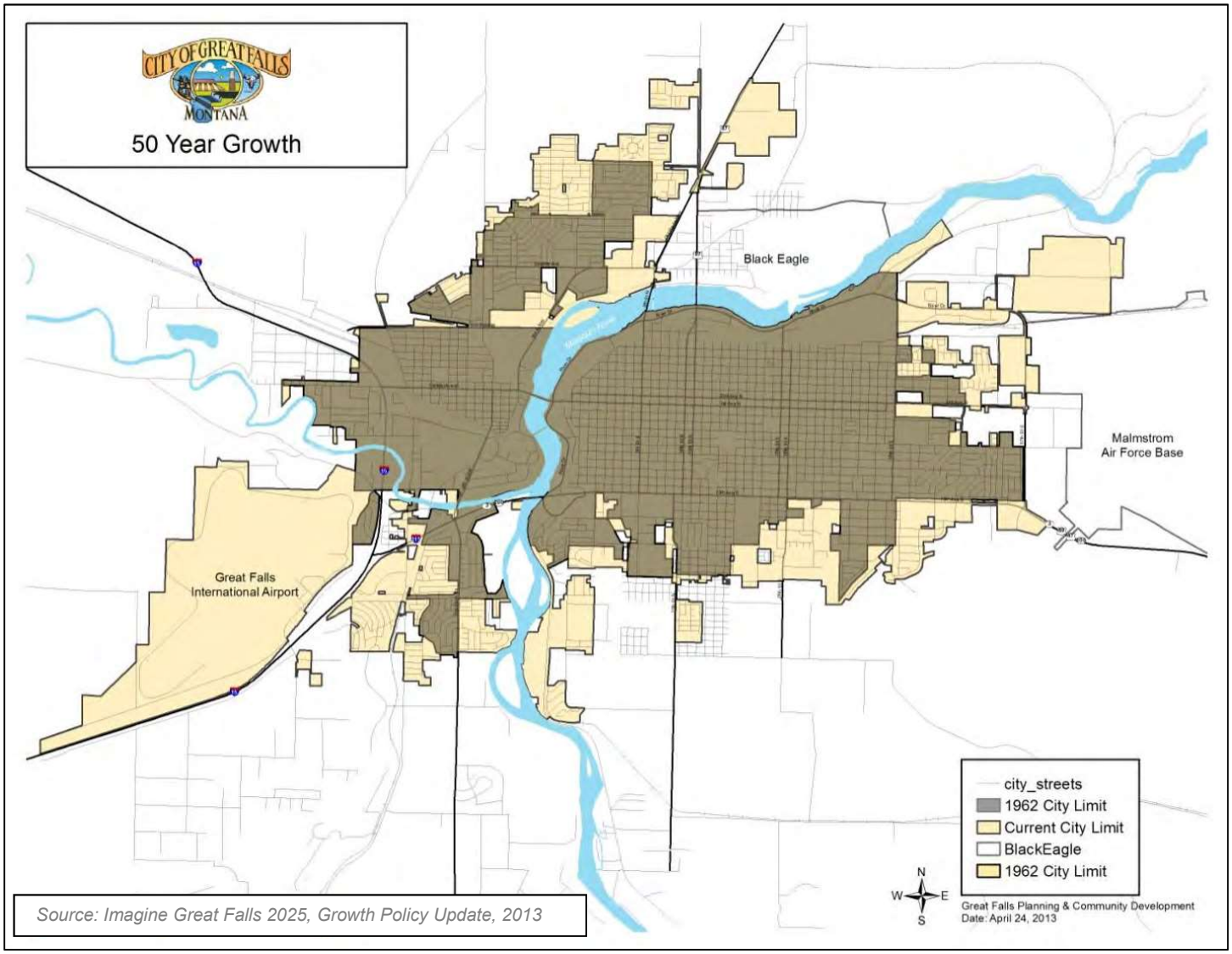


Figure 2: City Expansion Since 1962

Numerous special area plans have been produced in Great Falls in recent years which help identify development goals and objectives and contain detailed evaluations of localized areas within the community. These plans are listed below:

- Downtown Access, Circulation, and Streetscape Plan (April 2013)
- Malmstrom AFB Joint Land Use Study (March 2012)

- Downtown Master Plan (October 2011)
- Medical District Master Plan (January 2007)
- Missouri River Urban Corridor Master Plan (2004)

The City recently updated its growth policy through the *Imagine Great Falls 2025* project. As part of this effort, potential growth areas within the community were identified. These growth areas are shown on **Figure 3**. The principal areas for new residential growth are envisioned along the southern edge of the city in the southwestern portion of the community. Residential growth is also anticipated along the northern perimeter of the city west of US Highway 87. Non-commercial development and industrial growth are envisioned around the airport, east of US Highway 87 and north of Black Eagle, and in the northeastern portion of the urban area near Malmstrom AFB.

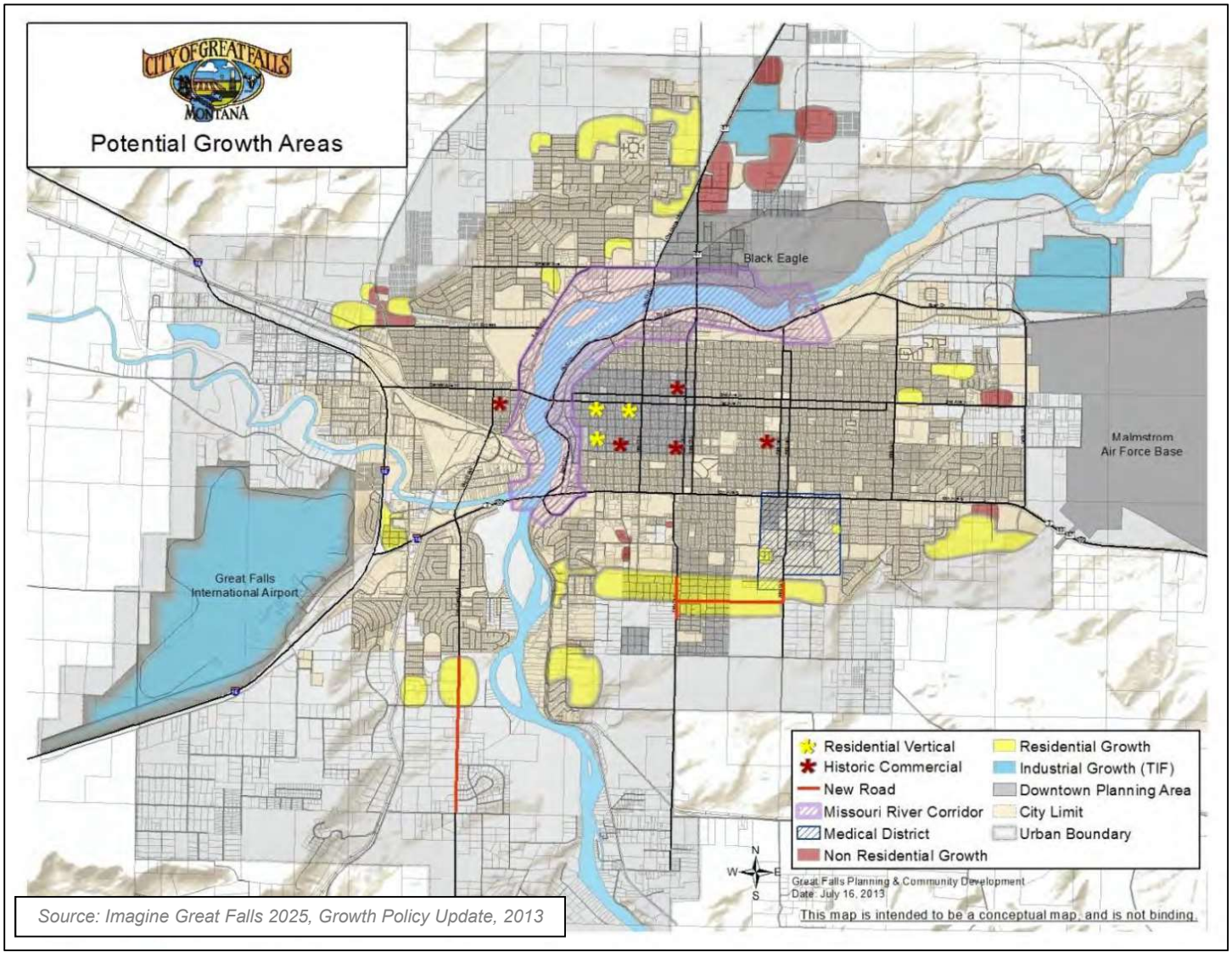


Figure 3: Potential Growth Areas

6.0 FUTURE PROJECTIONS

Projections are estimates of various characteristics at future dates. They illustrate reasonable estimates of future conditions based on assumptions about current or expected trends. Population and employment projections, in the form of housing units and total jobs, are used to help predict future travel patterns and assess the performance of the transportation system.

6.1. Population and Housing Projections

County level population projections are available from Montana Department of Commerce Census & Economic Information Center (CEIC)[1]. The CEIC projections were developed by Regional Economic Models, Inc. (REMI) and provide complete annual demographic forecasts through 2060 for the State of Montana and each county. The REMI model predicts a future population of 96,327 for Cascade County in the year 2038. The future projection in the REMI model was determined reasonable and was therefore used as the 2038 projected population for the LRTP. Similar projections are not available from the CEIC for the City or CDP areas.

The share of the population living within the LRTP study area, as compared to the County, was estimated using Census population data. GIS analysis was used to identify the total population within all census blocks entirely within or crossed by the study area boundary. This analysis established the study area population to be 68,967 in 2010. The population of the LRTP study area accounts for approximately 85 percent county's total population. The percent distribution of the county's population within the Great Falls study area was then carried forward for future projections, being held constant through the year 2038.

More so than population totals, the number of housing units is a key component in the travel demand model. Housing units distribute people throughout the network to given locations. They represent the population and act as a hub for traffic within the network. Having an accurate value for number of people per housing unit helps distribute the traffic more accurately. However, it is often quite difficult to accurately represent the population through housing units. This is in part because the number of people per housing units varies based on location and can change at any time.

According to the 2010 Census, Cascade County had a population of 81,327 people distributed among 37,276 housing units, resulting in an overall occupancy rate of about 2.18 people per housing unit. Within the study area, the 2010 Census showed a population of 68,967 people among 30,933 houses, resulting in an occupancy rate of 2.23. The occupancy rates for housing units in the County and in the study area were held constant for population and housing projections through 2038.

Since housing units are an important factor in travel demand modeling, the 2015 travel demand model uses housing units as inputs. It is possible to calculate the total population for 2015 by applying the occupancy rates determined by the 2010 census. This results in 83,079 people among 38,079 houses in the County, with 70,686 of those people residing in the 31,704 houses within the study area. Furthermore, applying the occupancy rates to the 2038 projected population (96,327 people) results in 44,151 houses in the County. Within the study area a population of 81,958 is forecasted with a total of 36,760 houses.

Table 14 shows population and housing unit projections for Cascade County and the study area. For the purposes of this plan, 5,827 new housing units were allocated within the study area, with an additional 1,048 housing units distributed in other areas of the county outside of the study area.

[1] Census and Economic Information Center, Montana Population Projections, Regional Economics Models, Inc., http://ceic.mt.gov/Population/PopProjections_StateTotalsPage.aspx

Table 14: Population Projections

Area	2010 (Census)	2015 (Calibrated Model)	2038 (Projection)	Net Change (2015-2038)
Cascade County Total				
Population	81,327	83,079	96,327	13,248
Housing Units	37,276	38,079	44,151	6,072
Population per Housing Unit				*2.18*
Great Falls Study Area				
Population	68,967	70,686	81,958	11,272
Housing Units	30,933	31,704	36,760	5,056
Population per Housing Unit				*2.23*
Outside Study Area				
Population	12,360	12,393	14,369	1,976
Housing Units	6,343	6,375	7,391	1,016
Population per Housing Unit				*2.18*

6.2. Employment Projections

Employment numbers are used in the travel demand model to help distribute vehicle traffic as accurately as possible within the street and road network. Places with high levels of employment will tend to generate high levels of vehicle traffic. The traffic generated is based in part on the employment type: either retail or non-retail jobs.

Employment estimates from the US BEA for Cascade County were given for the years 1970 to 2015 as discussed in **Section 4.1**. It was observed that the number of non-farm jobs within the County compounded annually at a rate of 0.70 percent since 1970. Using this growth rate, it is possible to project the number of jobs in the County out to the year 2038. Similar to the housing projections, the proportion of jobs within the study area as compared to the County is based on the 2015 travel demand model and is held constant through 2038. GIS analysis of the model determined that approximately 93 percent of the jobs in Cascade County are located within the study area.

The 2015 travel demand model also establishes the distribution of retail and non-retail jobs within the County and the study area. Retail and non-retail jobs accounted for approximately 18 and 82 percent of the total employment, respectively, in 2015. These percentages were held constant for future projections and were used to estimate the number jobs for the year 2038. Based on the historic growth rate for employment, and the breakdown of retail versus non-retail jobs, the total employment in Cascade County is projected to be 57,734 by 2038, which consists of 10,649 retail jobs and 47,085 non-retail jobs.

In order to accurately portray the traffic in the Great Falls area, the travel demand model uses a slightly different count of total jobs. The reason for this difference is due to the method in which trip rates are used in the model to distribute traffic throughout the road network. The travel demand model establishes the 2015 total employment for Cascade County at 40,402—including 7,452 retail jobs and 32,950 non-retail jobs. Again, 93 percent of the County's jobs are located within the study area which makes a total of 37,574 jobs in the study area, including 7,139 retail jobs and 30,435 non-retail jobs.

An additional 6,515 jobs (1,230 retail and 5,286 non-retail) were allocated within the study area. An additional 497 jobs were distributed in other areas of the county to account for the employment increases anticipated to occur in Cascade County by 2038. **Table 15** presents the employment projections used in the model for Cascade County and the Great Falls LRTP study area to the year 2038.

Table 15: Employment Projections

Area	2015 Estimate (US BEA)[a]	2015 Model	2038 Projection[b]	2038 Model[b]	Additional Jobs for Model (2015-2038)
Cascade County					
Total Jobs	50,348	40,402	57,734	47,414	7,012
Retail Jobs	-	*7,272*	*10,649*	*8,745*	*1,293*
Non-Retail Jobs	-	*33,130*	*47,085*	*38,669*	*5,719*
Great Falls Study Area					
Total Jobs	-	37,574	53,642	44,054	6,515
Retail Jobs	-	*7,139*	*10,126*	*8,316*	*1,230*
Non-Retail Jobs	-	*30,435*	*43,517*	*35,739*	*5,286*
Outside Study Area					
Total Jobs	-	2,828	4,091	3,360	497
Retail Jobs	-	*133*	*523*	*430*	*64*
Non-Retail Jobs	-	*2,695*	*3,568*	*2,930*	*433*

[a] *County employment statistics from US Department of Commerce Bureau of Economic Analysis – Table CA25 and Table CA25N.*
[b] *Projections calculated using 0.70% CAGR.*

7.0 ALLOCATION OF FUTURE GROWTH

Modeling of future travel patterns out to the year 2038 planning horizon using MDT's travel demand model required identification of future socioeconomic characteristics within each census block. County population and employment projections were translated into predictions of increases in housing and employment within Cascade County and the LRTP study area. To accomplish this task, the allocations made in the 2014 LRTP were used as a starting point. These allocations were based on a review of existing land use and zoning maps for the City of Great Falls and surrounding county area, City and County growth policies, and other community planning documents. These planning documents helped identify where residential, commercial and industrial development has occurred in the Great Falls area and provided information about where future residential and commercial growth is expected in the community. The allocation of future housing units and employment attempted to reflect known patterns of growth and potential new growth areas within the study area.

A land use forecasting workshop was held with representatives of the City and County as part of the 2014 LRTP. The purpose of the workshop was to discuss and reach consensus on the distribution of future housing and employment growth within the Great Falls area. This enabled local government staff to consider and revise the growth assignments as needed based on their knowledge of recent land use trends, land availability and development limitations, land use regulations, planned public improvements, and known development proposals.

Since the efforts for the 2014 LRTP were thorough and little change has occurred in the past four years, the allocations were still considered valid for the 2018 LRTP. However, projections are slightly different between the two LRTPs due to different base years and different planning horizons. To adjust for these differences, the allocations from the 2014 LRTP were modified to account for any recently completed developments and for any newly planned developments. **Figure 4** shows where future housing units are expected to be developed by the year 2038. Similarly, **Figure 5** shows where the projected increases in employment are anticipated through the year 2038.

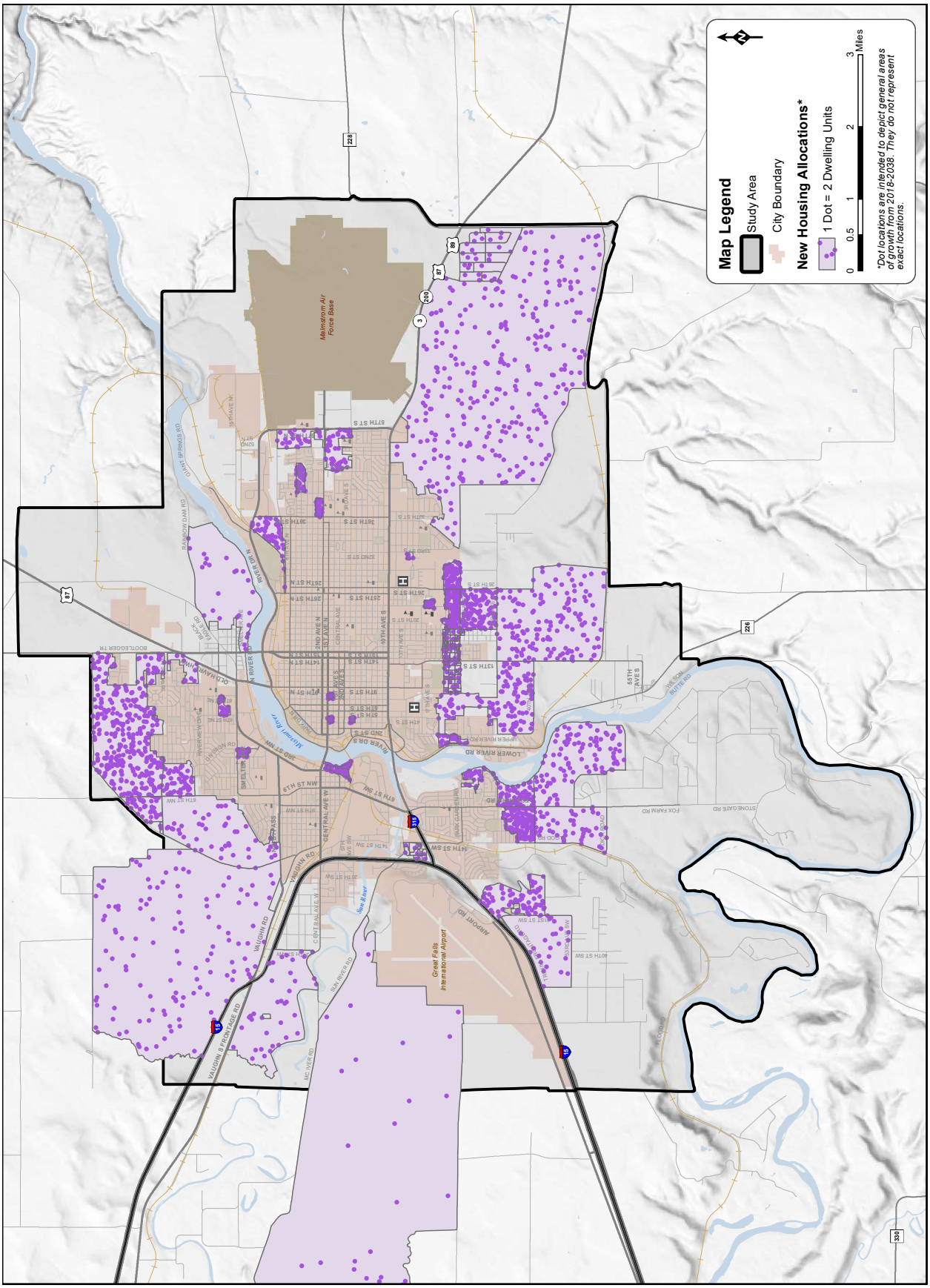


Figure 4: Future Housing Allocation

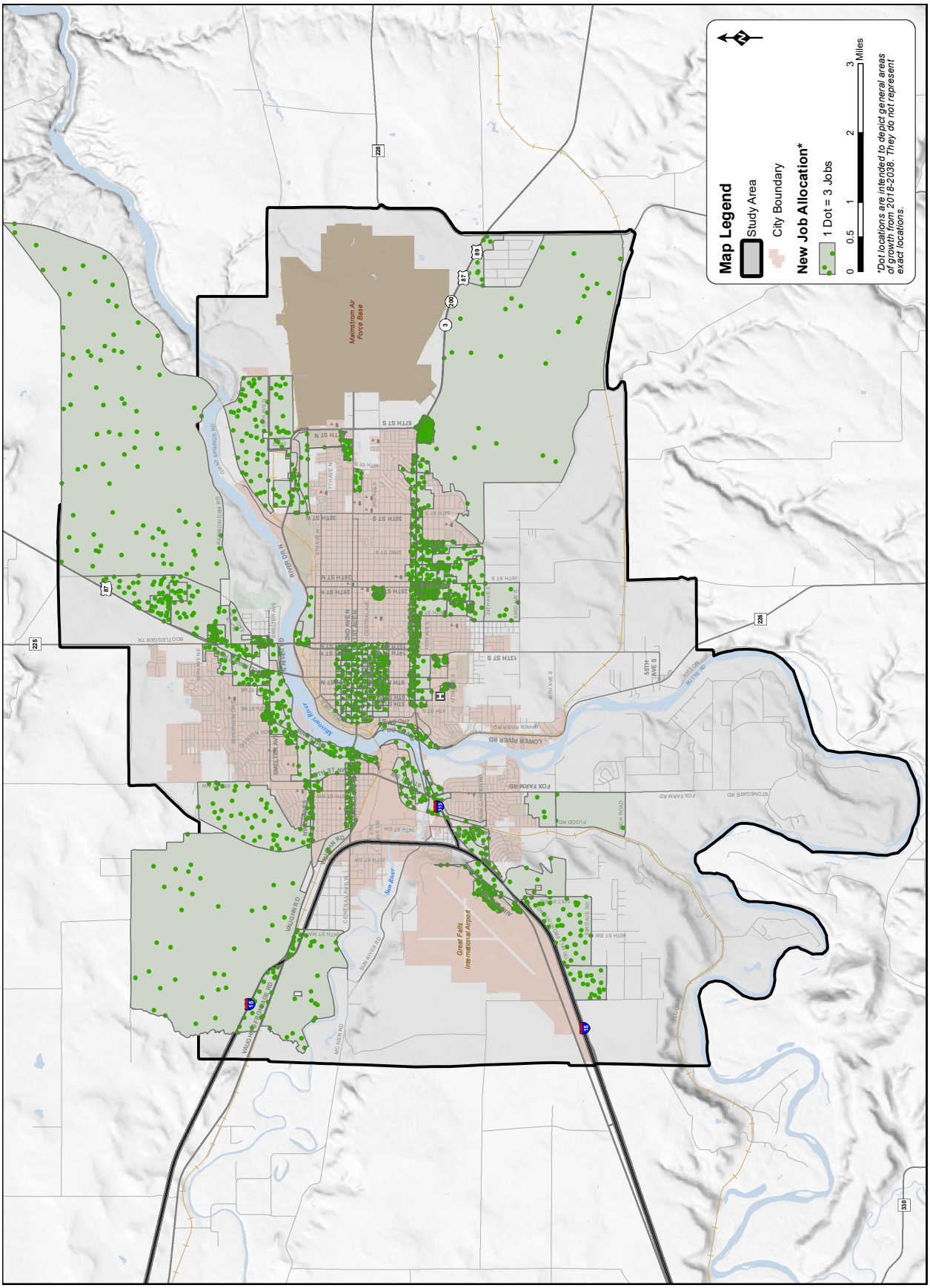


Figure 5: Future Job Allocation

APPENDIX E:
Existing and Projected TransportationConditions



EXISTING AND PROJECTED TRANSPORTATION CONDITIONS

March 12, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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EXISTING AND PROJECTED TRANSPORTATION CONDITIONS

1.0 INTRODUCTION

To clearly understand a transportation network, it is important to evaluate both the existing and projected conditions and use that information to identify any potential problem areas. Existing traffic data were used to establish the existing conditions on major road segments within the study area. The existing data were then projected out to the year 2038 using growth rates derived from a travel demand model built for Cascade County by the Montana Department of Transportation (MDT). Utilizing the existing and projected data, the operational characteristics and potential traffic issues over the planning horizon were determined. A variety of data were used to help evaluate the system, including:

- Existing functional classification,
- Existing traffic data,
- Existing bicycle and pedestrian data,
- Existing roadway corridor size,
- Current intersection turning movement counts,
- Current traffic signal operation information,
- Existing intersection and roadway configurations, and
- Historic crash data.

2.0 EXISTING TRANSPORTATION SYSTEM

Current information about the transportation system was analyzed to establish the existing traffic conditions and to determine potential problem areas. Existing data was provided in the 2014 LRTP and updated as appropriate using information provided by MDT, the City of Great Falls, and Cascade County. New data was not collected as part of this Update as the available data was determined to accurately represent current transportation conditions. The combination of data from the 2014 LRTP and the updated available data was used to determine the existing conditions of the transportation system.

2.1. Transportation Network

A transportation network is made up of many individual road segments which are connected in ways which permit vehicular movement. However, this network is not limited to personal vehicles, it is also meant to accommodate public transportation, bicycles, pedestrians, freight, rail, and other modes of transportation. Gaining a thorough understanding of each component of the transportation network will help ensure that all modes of transportation are able to navigate the transportation network safely and efficiently.

2.1.1. Major Street Network

To understand a community's existing transportation system, it is first necessary to identify which roadways will be evaluated as part of the larger planning effort. A transportation system is made up of a hierarchy of roadways, with each roadway being classified according to certain parameters. The parameters include, but are not limited to, geometric configuration, traffic volumes, spacing in the community's transportation grid, speed, and adjacent land use. Each of these characteristics helps define the role that each segment of roadway plays within the overall network. The method by which these roles

are defined is widely known as functional classification. Travel through a community involves movement through a network of roads. Functional classification defines the nature of travel within the network in a logical and efficient manner by defining the objectives that any particular road or street should meet to effectively move trips through the entire network.

For this evaluation, emphasis was placed on roadways within the study area that are functionally classified as collectors, minor arterials, or principal arterials. The local streets, the lowest ranking roadways, were not examined in detail due to the assumption that if the major street network (i.e. collectors and above) is functioning at an acceptable level, the local roadways should not be used beyond their intended function. However, if problems begin to occur on the major street network, then the resulting issues will begin to infiltrate the local road network. As such, the overall health of a community's transportation system can be characterized by the health of the major street network.

Included in the study area are roadways with the functional classifications of interstate system, principal arterial, minor arterial, collector street, and local street. For the purpose of this Plan, these functional classifications are neither limited to, nor defined by, "urban" or "rural" settings, though some entities often make a distinction between urban and rural functional classes. Rural roadways in the study area generally carry a smaller volume than their urban counterparts. Although traffic volumes may differ between urban and rural sections of a roadway, it is important to still maintain coordinated right-of-way standards to allow for efficient operation and potential urban development. **Figures 1** and **2** present the major street network for the study area. The figure shows existing roadway classifications. Note that the functional classifications shown in the figure may not represent the "Federally approved" functional classification system, rather, it shows the locally adopted classifications. These classifications are used for planning purposes and may not be representative of actual conditions. The following list provides general descriptions of these functional classifications.

Interstate Highways

The main purpose of an interstate highway is to provide for both regional and interstate transportation of people and goods. Primary users include all types, ranging from local residents and commuters, to travelers and freight operators. Interstate highways characteristically have fully controlled access (provided by a limited number of interchanges), high design speeds, and place a high priority on driver comfort and safety. The interstate system has been designed as a high-speed facility with all road intersections being grade separated.

Principal Arterial System

The purpose of a principal arterial is to serve the major centers of activity, the highest traffic volume corridors, and the longest trip distances in an area. This classification of roadway carries a high proportion of the total traffic. Most of the vehicles entering and leaving the area will utilize principal arterials. Significant intra-area travel, such as between central business districts, outlying residential areas, and major suburban centers, is typically served by principal arterials.

The spacing between principal arterials may vary; from less than one mile in highly developed areas, to five miles or more on the urban fringes. Principal arterials mainly connect to other principal arterials or to the interstate system. The major purpose of the principal arterial is to provide expedient movement of traffic, not access to abutting lands.

Minor Arterial Street System

The minor arterial street system interconnects with and supplements the principal arterial system. Minor arterials accommodate trips of moderate length at a somewhat lower level of travel mobility, as compared

to principal arterials. They distribute travel to smaller geographic areas in addition to providing some access to adjacent lands.

The spacing of minor arterial streets may vary; from several blocks to half a mile in highly developed areas of a town, to several miles in the urban fringes. They are typically spaced more than one mile apart in fully developed areas.

Collector Street System

The collector street network provides links from residential, commercial, and industrial areas to the arterial street network. This type of roadway differs from those of the arterial system in that collector roadways may traverse residential neighborhoods. The collector system distributes trips from the arterials to the user's ultimate destinations while also collecting traffic from local streets in the residential neighborhoods and channeling the traffic to the arterial system. The collector street system should intersect arterial streets at a uniform spacing of one-half to one-quarter mile in order to maintain good progression on the arterial network. Ideally, collectors should be no longer than one to two miles and should be continuous for their entire length.

Local Street System

The local street network comprises all facilities not included in the higher functional classes. The primary purpose of local streets is to permit direct access to abutting lands and connections to higher systems. Most local streets also provide residential and commercial access. Usually, service to through-traffic movements is intentionally discouraged either through low speeds or other traffic calming measures.

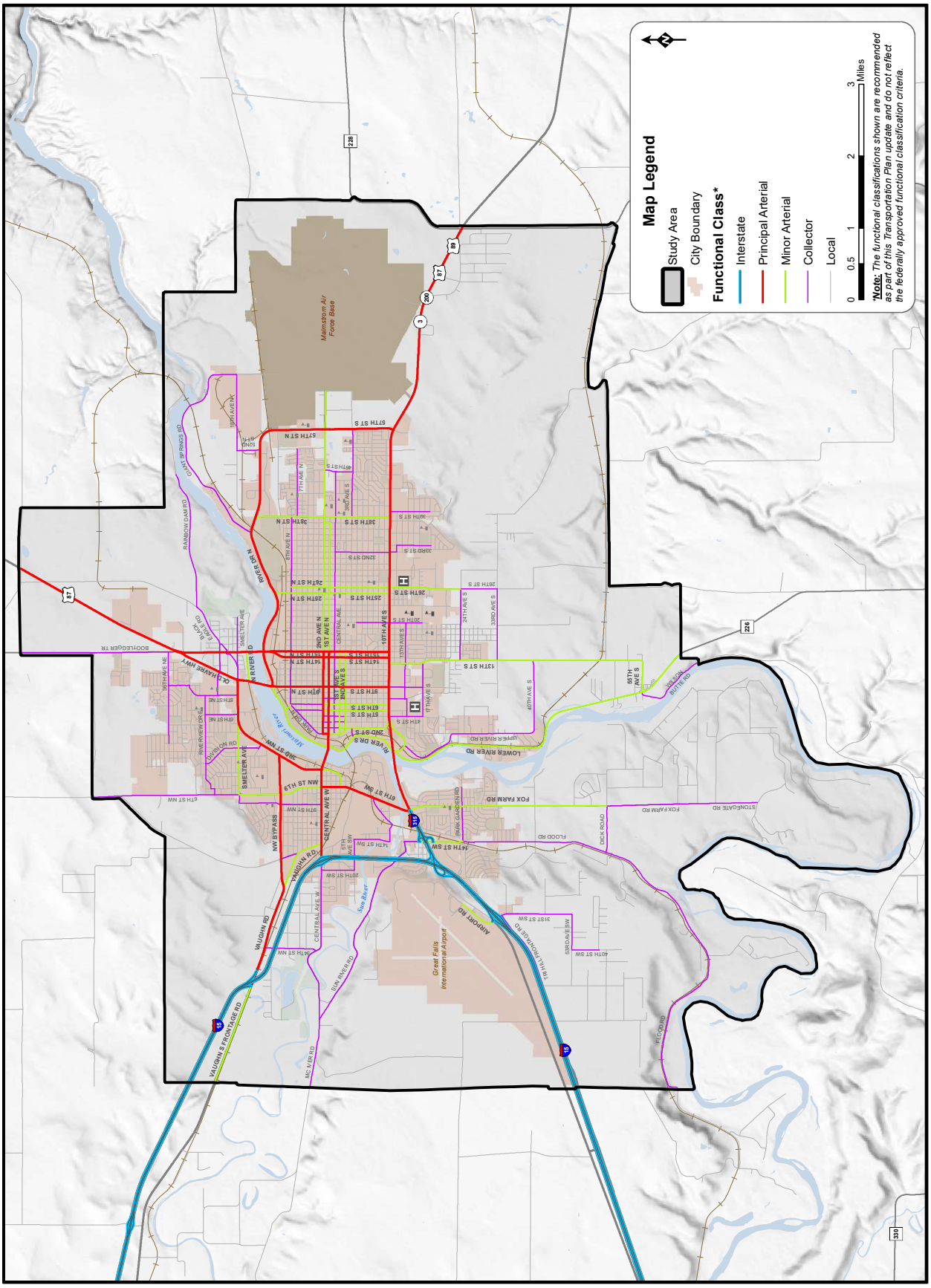


Figure 1: Existing Major Street Network

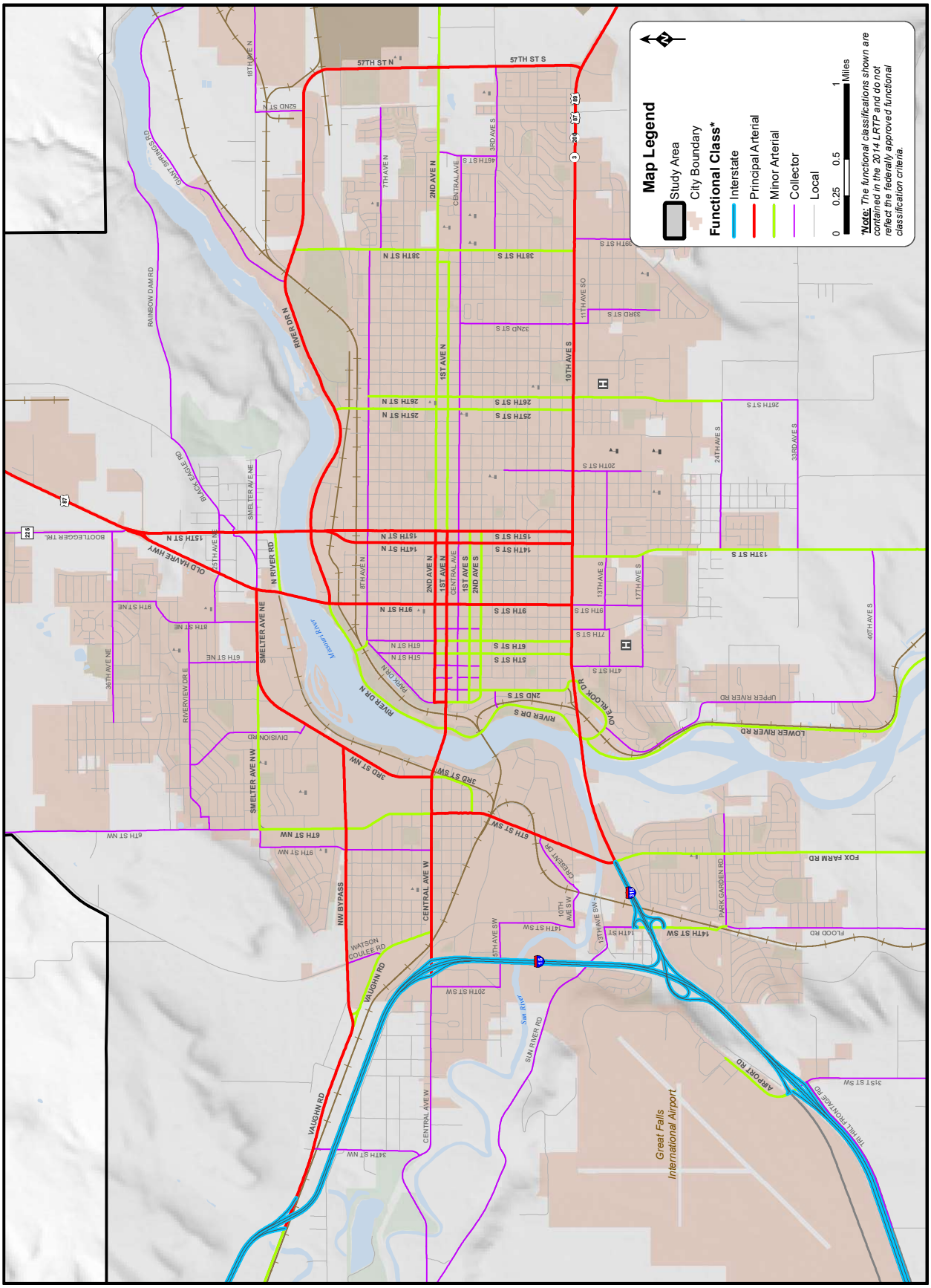


Figure 2: Existing Major Street Network (Detail Area)

2.1.2. Non-Motorized Transportation Network

An extensive effort was put forth for the 2014 LRTP to assess the existing non-motorized network conditions and determine the community's non-motorized needs. This assessment was performed by Alta Planning + Design and resulted in a thorough analysis detailing the existing facilities, policies, programs, and system deficiencies. The memo is included in **Appendix A** is summarized in this section. The content of the memo has been reviewed and any necessary updates were made in this section to ensure an accurate representation of current conditions.

BICYCLE AND PEDESTRIAN FACILITIES

The Great Falls Area is fortunate to boast an approximately 60-mile off-street bicycling and walking system along the banks of the Missouri River. In general, Great Falls' older core neighborhoods and grid street system with small blocks lend themselves to walking and non-motorized transportation. Pedestrians use sidewalks, trails, alleys, and bridges in and around the City, however, there is a relative lack of designated on-street bicycle infrastructure. The city's first bike lane was installed in Summer 2013. Some additions to the existing bike and pedestrian facilities have taken place since the development of the 2014 LRTP. As such, there are many opportunities for improvement to the non-motorized transportation network, especially improvements to the bicycle network. The following list describes the existing bicycle and pedestrian facilities in the study area. A map of the existing bicycle and pedestrian facilities is presented in **Figure 3**.

SHARED LANE MARKINGS

Shared lane markings, or sharrows, are stenciled markings installed as an on-street facility where bicycles share the travel lanes with cars. Typically, these facilities occur on local roadways or on roadways with low traffic volumes and speeds. These facilities are used to connect other bikeways – usually bike lanes - or designate preferred routes through high-demand corridors. In implementation, roadways with shared lane markings are accompanied by a Bike Route designation and appropriate signage. Examples of routes with shared lane markings in the Great Falls Area are those along 4th Avenue North and 8th Avenue North.



Bicyclist riding on the 4th Ave N shared roadway



57th St N/2nd Ave N bike lanes

BIKE LANES

Bike lanes are a type of separated bikeway that uses signage and striping to delineate the right-of-way assigned to bicyclists and motorists. Bike lanes encourage predictable movement by both bicyclists and motorists. The Great Falls Area currently has 2.6 miles of bike lanes. The 57th Street N/2nd Avenue N bike lanes were installed in June and July 2013 between the 2nd Ave N gate of Malmstrom Air Force Base on the east, west to the intersection of 57th St N and 2nd Ave N, and then north and northwest till 38th St N & the River's Edge Trail extension.

Natural Surface Trails

The River's Edge Trail (RET) is the most notable natural surface trail in the Great Falls Area. In general, natural surface trails serve as both transportation and recreational facilities. The RET is nearly 60 miles long and 35+ miles of the trail are made up of natural surface trail. These parts of the trail are primarily used for singletrack mountain bike riding and walking/hiking.



River's Edge Trail northwest of Downtown Great Falls



Paved portion of the River's Edge Trail

Shared Use Paths

Shared use paths are off-street paved trails that are designated for the use of bicyclists, pedestrians, and other non-motorized users such as skateboarders and rollerbladers. Approximately 25 miles of the RET is paved paths and trails.

Sidewalks

Most of the established areas of Great Falls have a very cohesive and continuous sidewalk network. On the outskirts and in new or fringe developments, however, such connectivity is lacking. Much of the latter areas were subdivided and built before being incorporating into the City (if at all), and most of the sidewalk gaps occur here. Developers and builders in unincorporated areas were not required to build sidewalks and they weren't included in the design of these neighborhoods. At the time of the 2014 LRTP, there were 37.62 miles of sidewalk gaps out of the 196 miles of potential sidewalk mileage within the City limits.



There are some locations in Great Falls where sidewalks end

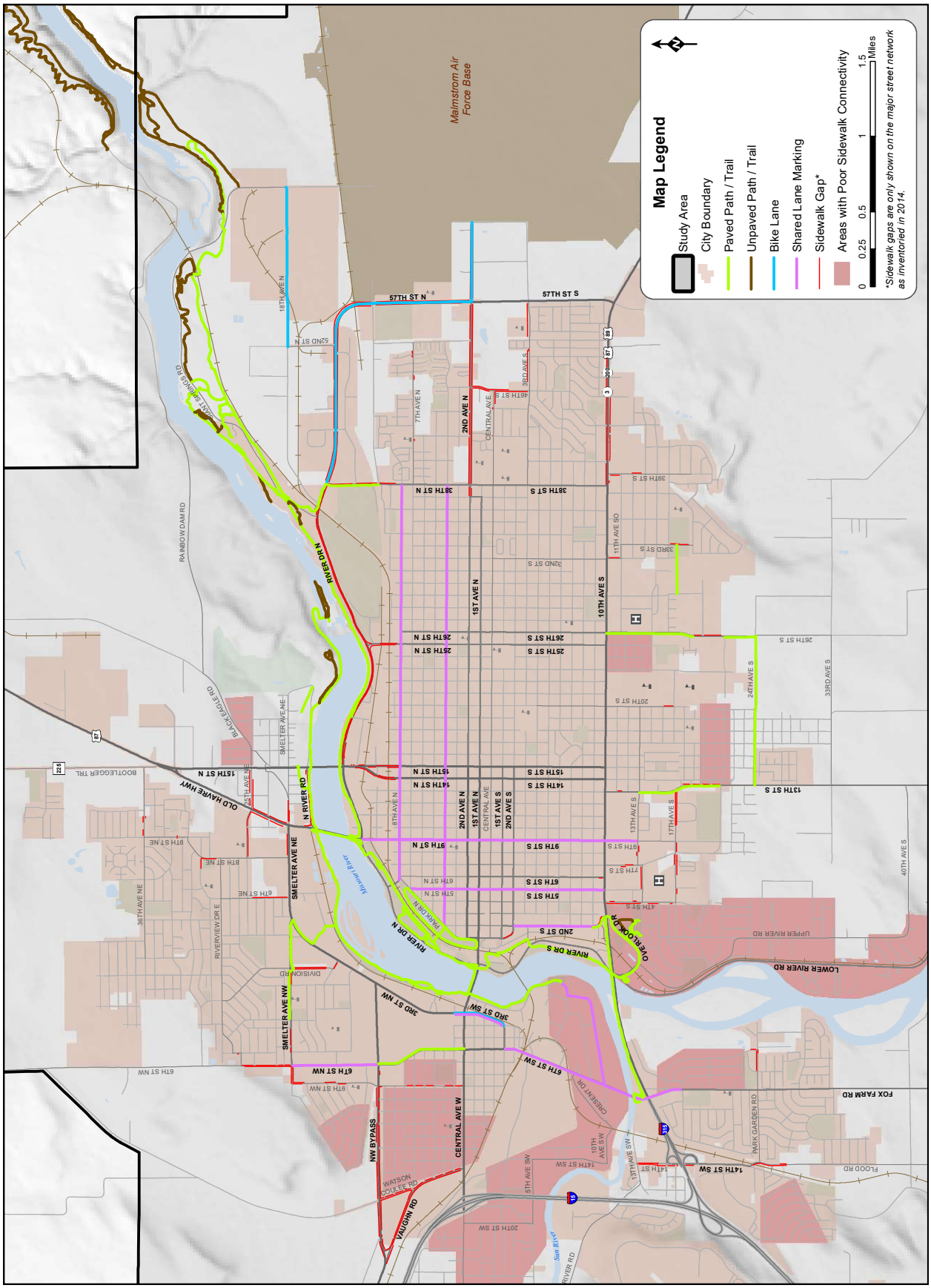


Figure 3: Existing Non-Motorized Network (Detail Area)

NON-MOTORIZED PROGRAMS

RIVER'S EDGE TRAIL

According to the River's Edge Trail website, the almost 60-mile trail system is the result of nearly 30 years of cooperative partnership efforts by the City of Great Falls, Cascade County, Montana Department of Fish, Wildlife & Parks (FWP), Montana Department of Transportation, electric utility PPL Montana, a volunteer trail advocacy group Recreational Trails, Inc., and a supportive community. As a result of this work, the RET has grown into a treasured community asset. Since 1989, the trail has grown to nearly 60 miles. The RET system is composed of 25 miles of paved paths and trails, and 35+ miles of unpaved or natural trails (primarily used for singletrack mountain bike riding and walking/hiking).[1]

The history of the River's Edge Trail began with a conceptual plan for a riverside recreational trail in Great Falls (as developed by the City-County Planning Board staff in 1989). Dubbed the "Riverfront Recreational Corridor", the trail was to extend 7 miles from the Broadwater Bay area downstream to Rainbow Falls. The trail, re-named the River's Edge Trail following a Name-the-Trail contest in the Great Falls Tribune, captured the interest and support of the community. A volunteer group that advocated local bike trails, also in 1989, as part of the *Vision 2000* community planning process, began working with the City to develop the first segments of the trail. That group was formalized as a non-profit 501 c3 corporation named Recreational Trails, Inc. (RTI).

Over the last 26 years RTI has continued to work with the City, County, FWP, PPL Montana and many other partners, agencies, groups and individuals to extend and improve the 60-mile trail. In 2015, the City of Great Falls assumed full management of the trail, hired a trails coordinator in 2016, and RTI transitioned into the River's Edge Trail Foundation.[2] Much of the trail has been constructed on abandoned railroad and road rights-of-way and structures. Miles of new trail connecting these segments have been constructed, as have many new tunnels, underpasses, bridges and trailheads. Volunteers have undertaken an on-going intensive cleanup of riverfront lands that had been littered with debris over the past decades, and have spent thousands of hours on weed control, tree planting, maintenance, and enhancement projects.[3]

GET FIT GREAT FALLS

Get Fit Great Falls (GFGF) is a group that desires to have a healthier and more active community that is also more economically vibrant and physically active. Get Fit Great Falls is made up of representatives from 20 community organizations and agencies and although it is not officially a non-profit organization, it has been successful in its initial initiatives to encourage more walking and bicycling to Great Falls Voyagers baseball games, overall walkability of the City, and improving the relationship between pedestrians and other roadway users. Bicyclists and pedestrians sharing sidewalks can be dangerous according to GFGF and an improvement on the current situation is another goal of the organization. Focusing also on wheelchair accessibility and safety concerns for disabled users, GFGF has sought to work with the City to close sidewalk gaps and improve ADA access.

ADA ACCOMMODATIONS

An ADA ramp is an inclined ramp that allows access for those in wheelchairs, with other disabilities (including the elderly), and those pushing carts or strollers to transition gradually and safely between the

[1] *Jenn Rowell. Changes to the trail: City will play larger role. Great Falls Tribune, 6 Feb. 2016,* www.greatfallstribune.com/story/news/local/2016/02/04/rivers-edge-trail-great-falls-gem/79858560

[2] *"Formalizing River's Edge Trail Foundation's partnership with the City of Great Falls." The River's Edge Trail. Web. 5 Jan. 2017.* http://thetrail.org/formalizing-rivers-edge-trail-foundations-partnership-city-great-falls

[3] *"History of the Trail." The River's Edge Trail. Web. 5 Aug. 2013.* http://thetrail.org/history.html

sidewalk and the street, similar to the way a driveway curb cut allows a car to access a driveway and the roadway.

The City of Great Falls has made a significant effort in creating curb ramps or ADA ramps in recent years. In 2017, the City released the *Public Right of Way ADA Transition Plan*[4] which identifies barriers to accessible transportation on City properties and in the public rights of way and outlines methods to remove these barriers. To date, the City of Great Falls has:

- 5,626 corners total
- 1,074 ADA compliant ramps
- 1,843 non-compliant ramps
- 2,709 corners without ramps
- 90 traffic signals
    - 37 signals without pedestrian push buttons
- 600+ miles of sidewalk

The Plan concluded that, based on field inventory and analysis, 63 percent of curb ramps in the City are non-compliant with ADA regulations. Twenty-eight ADA program methods have been established to help meet compliancy standards. The methods are broken down into three categories: (1) Administration, (2) Communications, and (3) Right-of-way related methods which are further broken down into ADA Inventory, Project Identification, Design and Construction, and Operation and Maintenance. Each year an Annual Action Plan will be completed which will include an implementation plan and schedule depending on that years available funding mechanisms.

The Great Falls Transit District ADA advisory committee is currently without effective guidance or leadership, but its role has traditionally been to advise the Board of Trustees or Directors on issues regarding wheelchair access and accommodating and providing services for those with disabilities who use the transit system. In the past, their priority was a curb cut, or ADA ramp, program. Once that began to pick up speed and more ADA ramps were installed on sidewalks, interested members of that committee dwindled and stopped coming to meetings.

FACILITY MAINTENANCE

RIVER'S EDGE TRAIL

Maintenance of the River's Edge Trail is shared between the Great Falls Parks and Recreation Department, Region 4 of Montana State Parks, and The River's Edge Trail Foundation with funding for maintenance provided by city funds and grants, private donations, and funds raised by the foundation. Maintenance includes resurfacing, weed abatement, riverbank work, signage, equipment, and labor.

The new trail coordinator position is funded by the city's general fund and transportation funds from the city planning department with the two funds splitting the $70,000 cost. In addition to funding the coordinator position, yearly maintenance of the trail is approximately $120,000+. Maintenance funds are primarily provided by the RET Foundation, however funds are also contributed by the City of Great Falls. The City's Trail Division budget for the 2017 fiscal year was $122,273.

[4] *"Public Right of Way ADA Transition Plan 2017." City of Great Falls. June 6, 2017.*

Street Sweeping

Currently, there is no preferential treatment for streets with designated (separated or otherwise) bikeways. In the case of 8th Ave N (bike route), however, it is on a preferential schedule due to its nature as a snow route and a collector street.

In the fair-weather seasons in Great Falls, sweeping is done from west to east in the older City core (grid system), and then continues into the surrounding areas (e.g. south of 10th Ave S, and in the Riverview and Valley View neighborhoods). The Downtown core is on an enhanced schedule that includes 4 am sweeping so as to take advantage of the lack of motorized traffic and on-street parking (in commercial areas). Sweeping may also be performed as needed after heavy summer storms to clean up impacted areas (fallen branches, leaves, and other debris).

The City of Great Falls also sweeps in the winter in order to clear debris from the streets. It is done during breaks in the snowfall and preference is give (as mentioned before) to snow routes and arterials and collectors.

MDT sweeps all of the routes over which they have jurisdiction as needed. With the introduction of salt brine as a preventative measure, their sweeping has been cut down considerably. Although most sweeping is for spot improvements, maintenance crews do pay more attention to high usage routes such as 10th Ave S, 14th/15th St, and other major roadways.

On-street Snow Removal

The Great Falls area receives approximately 62 inches of snow per year, receiving the most snow in March. The River's Edge Trail gets plowed before most streets because it is maintained by the Parks and Recreation Department, which is responsible for fewer routes than the Public Work Department, which maintains most roads.

Sidewalk Maintenance

Within the Great Falls city limits, there are no programs for sidewalk maintenance or replacement. Per Montana state law, sidewalk maintenance including tree root heaves, crumbling, etc., is the responsibility of the adjoining property owner(s) and is only enforced by the City or the jurisdictional authority. In the case of sidewalks inside of Great Falls city limits, this authority would be the City. Otherwise, it would be Cascade County. At the City level, at least, this process is complaint-driven and is thus reactive, and not proactive. After receiving a hazardous sidewalks complaint, a member of the City's Engineering Department staff performs a site inspection to determine if it is, in fact, a condemnable defect. If that is the case, a letter is then issued to the property owner notifying them of the defect and that they will be allowed 30 days for repairs. In 90 percent of cases, according to the City of Great Falls, the owner complies and the defect is remedied. The remaining 10 percent require a condemnation process that continues with the City hiring a contractor to do the repairs and the owner being charged for any labor and materials needed. If the owner does not pay for the repairs after they have been completed, then a lien is place on the property.

In some cases where the defect is very minor, like small rises (usually less than one inch) in sidewalks sections that turn into "toe stubbers", especially in Downtown, grinding the concrete level has been done. Grinding, however, is limited to very minor offsets and to strong or newer concrete because old or deteriorated concrete tends to shatter.

In rare cases, the City or MDT has paid for sidewalk replacement or repair in full when it was part of a larger project, like the addition of ADA ramps, asphalt milling, and overlay projects on 1st and 2nd Ave N.

For MDT, their involvement in the issue depends on the extent of the repair required by the offset or deterioration. Their rule of thumb is that if is more than six linear feet of repair, then they will consider it more than "maintenance" and will fix it with public funds. Even with this program, businesses have also fixed larger repairs on their own.

NON-MOTORIZED NEEDS ANALYSIS

A public survey was created as part of the 2014 LRTP plan in order to collect information about the preferences and key identifiers of different types of people interested in bicycling and walking in the Great Falls area. The survey was not statistically valid (because of the reach and response) and were distributed and promoted primarily by stakeholder groups in the transportation planning process and advertised in the newspaper. A total of 298 people responded to the "Bicycling Survey" and 192 people responded to the "Walking Survey".

BICYCLING SURVEY

When considering responses from all 298 respondents, they all self-identified as the following types of bicyclists or potential bicyclists:

- **Strong and Fearless: 19 percent**
  Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles - over separate bikeways such as shared use paths.

- **Enthused and Confident: 39 percent**
  This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

- **Interested but Concerned: 34 percent**
  This user type comprises the bulk of the population and represents bicyclists who typically only ride on low traffic streets or shared use paths under favorable weather conditions. These people perceive significant barriers to increased cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.

- **No way No how: 8 percent**
  Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances.

Survey takers were given the chance to select which facilities and types of bikeways they preferred or wished to have in their community (on a scale of 1-5, with one being least desirable and five being the most, depending on how much they liked it and how desirable it was). Most of the bikeways types received an average score of 3.5, but shared use paths received a 4.3, which is indicative of the fact that Great Falls residents are familiar with this type of facility (River's Edge Trail) and may not be familiar with other types.

When asked what their normal destinations are in Great Falls, respondents showed that trails, open space, and community spaces are among the most visited and cherished. The top 5 destinations among respondents were:

- River's Edge Trail
- Downtown Great Falls
- Gibson Park
- Giant Springs Interpretive Center
- Riverfront parks

When asked what methods they would prefer in order to improve bicycling in Great Falls, the only choice that received a higher score than 4 (on a scale of 1 to 5), was "Maintain existing bike paths" with all other options receiving an average score of 3.6, the lowest being 3.34 ("Traffic calming to slow cars"). This does not mean that survey respondents don't want bicycling improvements and different methods to accomplish a cohesive system, but it does mean that improving maintenance of existing facilities, especially paths and trails, is the number one priority for them right now.

Walking Survey

Respondents were asked about their walking habits. About half (49 percent) of respondents walk a few times per week, the next most common response was "5+ times per week" with only a cumulative 10 percent of respondents saying that they walk a few times per month or never.

Most respondents walk primarily for exercise and the next reasons are, in this order: spending time outdoors, transportation to a destination, social visits, and walking to school.

An overwhelming amount of people surveys responded that they currently enjoy walking on the River's Edge Trail, with the next most popular responses being "riverfront parks", "Downtown Great Falls", and "grocery stores".

Nearly 50 percent of respondents say that it only takes one to five minutes to walk to a park or playground, 30 percent have a 6- to 10-minute walk to a small grocery store, and 35 percent have an 11- to 20-minute walk to a supermarket. There was an even split of about 18 percent of respondents who lived 21 to 30 minutes walking from a supermarket, fast food restaurant, pharmacy, or trail or greenway. Only 10 percent of respondents lived within a one- to five-minute walk from a trail or greenway.

Approximately 70 percent of respondents said that they would walk more often if there were more sidewalks, greenway trails, and safe roadway crossings (in that order) according to the preference survey question.

Automobile speed & traffic, lack of sidewalks & trails, and a lack of pedestrian crossings at intersections were the top 3 reasons why people surveyed choose not to walk. Connectivity was also a big draw for respondents who said that they would like to see more pedestrian connectivity between neighborhood, shopping centers, park, and other destinations more than any other improvement. Marked crosswalks and sidewalks rounded out the top three.

Interestingly, 10th Ave S and Fox Farm Rd seemed to pop up more than others in open-ended questions that asked for additional thoughts on locations or corridors that could be improved for pedestrians. Respondents cited these as routes and barriers that were difficult to use and were unattractive as a pedestrian.

2.1.3. Transit Network

The history of the existing public transit system in Great Falls goes back to 1978 when, by voter referendum, the establishment of a Transit District was approved. The purpose of the Transit District is to provide an alternative form of transportation to city and county residents in the Great Falls area. Funding for the district is provided through a combination of fare collections, property tax revenue, and Federal funds. The latter is administered by MDT and goes towards operating and capital costs. Passenger service started in February of 1982.

Since the creation of the Great Falls Transit District (GFTD), a variety of studies and plans have been created to assist the District with operations, and specific measures to improve financial sustainability and customer needs were identified. A comprehensive *Transit Development Plan (TDP)* was completed by LSC Consultants on October 9, 2010. Much of the existing and proposed information presented herein relies heavily on the TDP.

TRANSIT FACILITIES

The GFTD operates seven regular fixed routes. The fixed routes operate from roughly 6:30 AM to 6:30 PM on weekdays and from 9:30 AM to 5:30 PM on Saturday. Six of the seven routes, with the exception of Route 7-Southwest, operate on 30-minute headways during the morning and afternoon peaks (6:30 AM to 9:30 AM and 2:30 PM to 6:30 PM). This allows for extensive coverage during both school hour and commuter business hour travel times. Saturday service is hourly on every line. There is no transit service provided on Sundays.

The seven lines radiate from a timed-transfer point downtown at 1st Avenue South and 4th Street (referred to as the Downtown Transfer Station). Lines one thru four make a timed connection at 10th Avenue South and 57th Street South (in the "Walmart East" parking lot). Lines five and six also make a timed connection at Division Road & 23rd Avenue NE.

A short description of the seven transit routes, along with their primary service market and basic ridership characteristics, is contained below. The seven routes are also shown graphically on **Figure 4**.

Route 1 (Southeast): This route serves various medical facilities, shopping destinations, lower and higher educational facilities, and residential areas. The presence of all these components makes Route 1 one of the strongest lines in the Great Falls system. Route 1 achieves this performance despite being very slow and circuitous. This route snakes its way through the area on minor streets, rather than running straight along an east – west roadway route. Route 1 gets relatively strong ridership all day, without a significantly strong morning or evening peak.

Route 2 (Central): This route serves Central Avenue from the Central Business District (CBD) to 44th Street, then turns south and east along 3rd Avenue South to the East End Timed Transfer Hub. Route 2 serves numerous public and private schools, some commercial areas, and extensive residential areas. This route has an average demand when compared to other routes, and primarily serves the schools on Central Avenue. Route 2 is comparatively consistent in its productivity throughout its entire length, with boardings occurring along the entire route, with primary focus centered around the various adjacent schools.

Route 3 (Northcentral): This route primarily runs along 8th Avenue North and has consistently low ridership when compared to the boardings of Routes 1 and 2. Route 3 runs adjacent to residential areas, a few small commercial centers, and services the Malmstrom Air Force Base. Ridership is generally low along the entire route, with the exception of each end. Route 3 is the only line that has a significant morning and evening peak at typical work-commute hours, with virtually no school hour peak.

Route 4: (Southcentral): Route 4 has its highest boarding counts between the CBD and 20th Street South. Daily activity is strongest in the early morning and mid-afternoon. These times correspond with school arrivals and releases. Additionally, there is a slight peak in the late evening, including some commuter traffic. However, as a whole this route has the lowest boardings of all routes.

Route 5 (Northwest): Route 5 has high boardings around CM Russell High School, and in the older west side neighborhood around 3rd Avenue Northwest and 14th Street Northwest. Except for these two areas, each end of the route and Central Avenue West are the only areas of any significant activity. Ridership peaks in the early morning and in the mid-afternoon, corresponding to the beginning and end of school.

Route 6 (Northeast): Ridership on Route 6 occurs primarily at a few locations: the transit center, North Middle School, Skyline School, and Wal-Mart. There are also a number of boardings around the node of commercial land uses at the intersection of 10th Avenue North and 14th Street North, which includes the Women's Transition Center. Other than these points, the route has few boardings on the rest of its length. Daily activity on Route 6 is greatest in the morning and in the mid-afternoon, corresponding with school hours.

Route 7 (Southwest): This line provides service to the Marketplace Shopping Center on 14th Street Southwest, via Fox Farm and Park Garden Roads. As development has increased in these areas, the route has grown over the past decade, and now realizes boardings on par with other routes, on average.

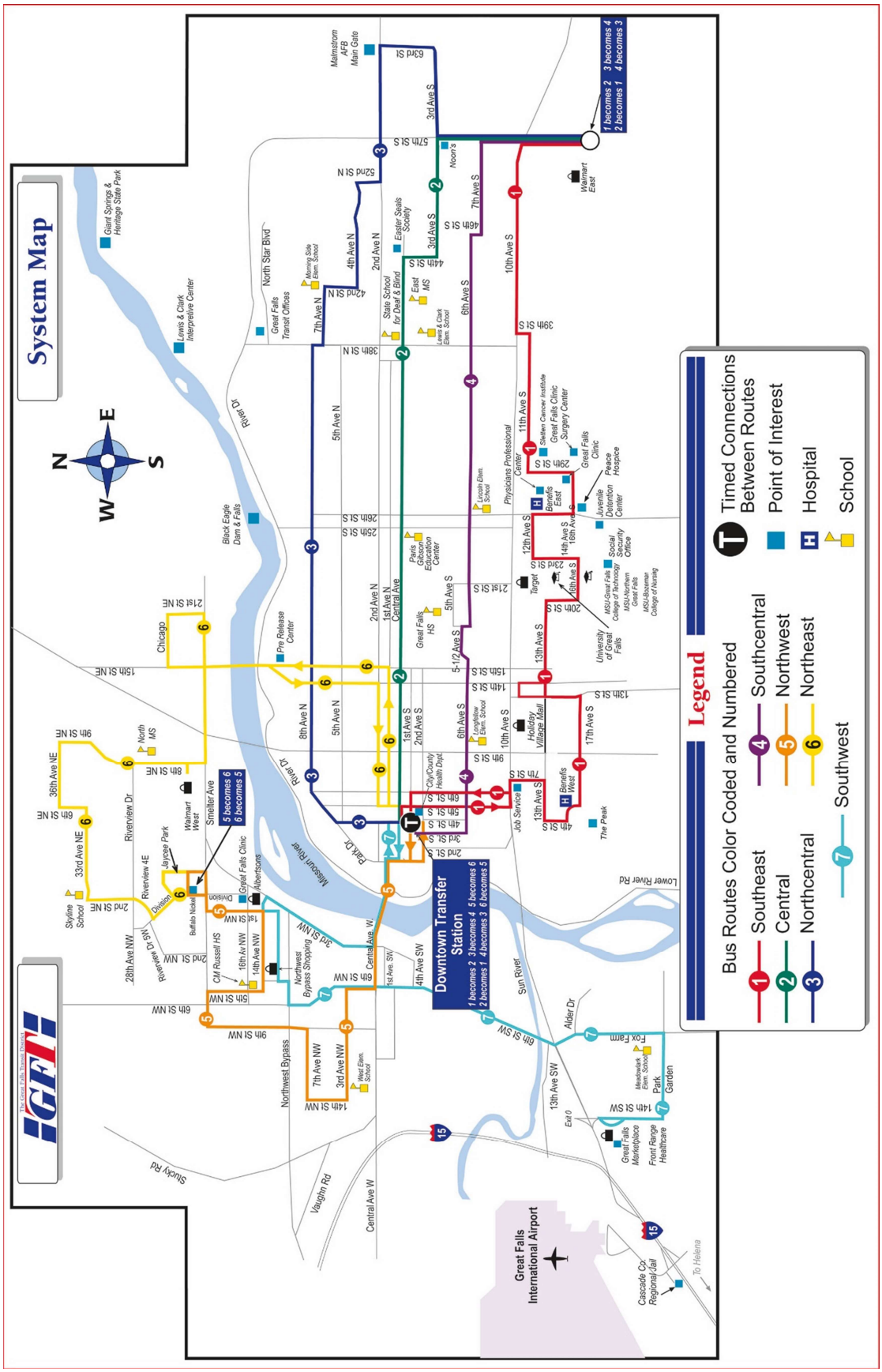


Figure 4: Existing Transit System Route Map

The current transit rate schedule is shown in **Table 1**.

Table 1: Transit Rate Schedule (2018)

Fare / Pass	Current Rate
Fare	
Adult	$1.00
Student (Full-time with ID)	$0.75
Senior Citizen (60 yrs or older)	$0.50
Disabled (with I.D.)	$0.50
Children (5 yrs and Under)	FREE
Transfers	FREE
Paratransit Service Clients (with I.D.)	FREE
Pass	
Regular Punch Pass	$10.00
Student Punch Pass	$10.00
Senior Citizen Punch Pass	$10.00
People with Disabilities Punch Pass	$10.00
Regular Monthly	$30.00
Student Monthly	$25.00
Monthly Pass for Seniors and People with Disabilities	$21.00
Day Pass	$4.00

Source: http://www.gftransit.com/fares_&_passes.htm (accessed January 4, 2018)

PARATRANSIT OPERATIONS

There are a number of paratransit operators that provide an alternative transit mode of travel to system users in the community. First and foremost is the paratransit known as the "Access Transportation Service", which is the ADA paratransit service provided by Great Falls Transit. The service is restricted to eligible registrants based on a functional assessment administered by the Great Falls Transit staff. The service is provided under contract by Diamond Cab and Diamond Wheelchair Services.

In addition to the service provided by the Diamond Cab Company, there are several retirement developments that provide service to residents of the various retirement facilities. Some of the facilities that are served by Aging Services are the Lodge, Cambridge Court, Cambridge Place, and Rainbow Retirement Center.

CONNECTIVITY TO TRANSIT

Trips by transit (in Great Falls' case, by bus) often begin and end on foot or bicycle or both. When connectivity to transit is poor, ridership and ease of use of the system is also negatively affected. By improving sidewalks at and near bus stops, constructing bus shelters for waiting patrons, and planning routes near popular bicycling and walking routes, citizen connectivity to transit can improve.

The GFTD bus route network is mostly a flag-down system, but there are plans and programs now in place to include fixed stops and the amenities that go along with them. A completely fixed stop system has been discussed internally at GFTD, but a plan for implementation has not been created yet. The advantages of a fixed stop system, especially for bicyclists and pedestrians, would be, among others, improved predictability of route time tables and scheduling, both for the user and the Transit District.

BICYCLING

Nearly all GFTD buses now have bike racks mounted on the front of the bus that allow users to use buses to connect longer legs of a trip, in case of an emergency or breakdown, or to avoid inclement

weather or difficult topography. GFTD has not, however, tracked or counted their use to determine demand on certain routes, or where bicyclists board and alight most.

WALKING

The GFTD is currently focused heavily on addressing connectivity to newly implemented fixed stops via sidewalks and applicable improvements. The City's Planning Department expressed interest in seeing GFTD provide a priority analysis on Safe Routes to Schools and sidewalks and their relationship with transit accessibility. According to the City and GFTD, there are transit users with limited mobility who use paratransit and other transit services because there are not sidewalks where they want to go or that access traditional bus stops and not necessarily because they require a paratransit ride.

TRANSIT GOALS

One of the immediate goals of the GFTD is to work towards implementation of the service design changes recommended in the current TDP. Local governments should continue to support the Transit District to the greatest extent possible. In some cases, this may be in the form of requirements that a new development provide some sort of infrastructure compatible with transit facility usage. It may also mean expansion of Transit District boundaries as development occurs around the perimeter of the community. The mission of the GFTD as articulated in their current TDP is as follows:

"The mission of the Great Falls Transit District is to provide a safe, reliable, affordable, and fiscally sound transportation system for the people of Great Falls and Black Eagle, Montana."

The five basic goals that govern the day-to-day operation of the system, and which were presented in previous study efforts, are as follows:

- Maintain the existing ridership base while attracting new riders;
- Continue to enhance the environmental sustainability of the transit system;
- Provide high quality, customer-oriented service;
- Provide efficient, effective, and safe services; and
- Promote the transit service.

2.2. TRANSPORTATION CONDITIONS

In order to get an accurate representation of the existing roadway network in the Great Falls Area, it was necessary to collect and analyze a significant amount of data. The data aids in the understanding of how the current road network is operating and gives a basis for determining future planning needs.

2.2.1. Existing Roadway Volumes and Capacity

Existing roadway traffic data were collected by MDT, the City of Great Falls, and Cascade County. The data were used to establish traffic conditions and to provide reliable data on historic traffic volumes. The existing facility size for the major street network is presented in **Figure 5**. Facility size is a qualitative observation of the number of travel lanes and physical divisions of the roadway. The existing Average Annual Daily Traffic (AADT) along the major street network is presented in **Figure 6.**

The capacity of the roadways is of critical importance when looking at the growth of the community. As traffic volumes increase, vehicle flow deteriorates. When traffic volumes approach and exceed the available capacity, users experience congestion and vehicle delay. As such, it is important to investigate the size and configuration of the existing roadways and to determine if these roads need to be expanded to accommodate the existing or projected traffic demands. The capacity of a roadway is based on various features including the number of lanes, intersection function, access and intersection spacing, vehicle

fleet mix, roadway geometrics, and vehicle speeds. Individual roadway capacity varies greatly and should be calculated on an individual basis. However, for planning and comparison purposes, theoretical roadway capacities were developed based on the existing roadway configuration. **Table 2** presents the capacities, given in vehicles per day, that have been used for this work. The values given in the table are not intended to be used to set any thresholds for roadway performance, but rather provide general information to be used for comparison purposes.

Table 2: Theoretical Roadway Capacity

Road Configuration	Capacity (vpd) [a]
2 Lane	12,000
2 Lane - Divided / TWLTL	18,000
3 Lane	18,000
3 Lane - Divided / TWLTL	24,000
4 Lane	24,000
4 Lane - Divided / TWLTL	32,000
6 Lane - Divided / TWLTL	48,000
Interstate	68,000

[a] Values represent planning level daily capacities developed for this Transportation Plan and are intended for comparison purposes only. Actual physical roadway capacity can vary greatly depending on road design features and access control.

A roadway's capacity, and associated volume-to-capacity (v/c) ratio, can be used as a comparison tool when looking at the transportation system. The v/c ratio of a roadway is defined as the traffic volume on the roadway divided by the capacity of the roadway. **Figure 7** presents the resultant v/c ratios for the existing major street network.

A v/c ratio that exceeds 1.00 is typically a sign that the volumes on the roadway are greater than the available capacity on the roadway. When this occurs, higher than normal vehicle delay is generally experienced. However, as mentioned previously, the theoretical roadway capacities are used for comparison purposes and actual physical roadway capacity can vary greatly. Consequently, the v/c ratios in **Figure 7** should be used to help identify potential capacity deficiencies on the transportation system.

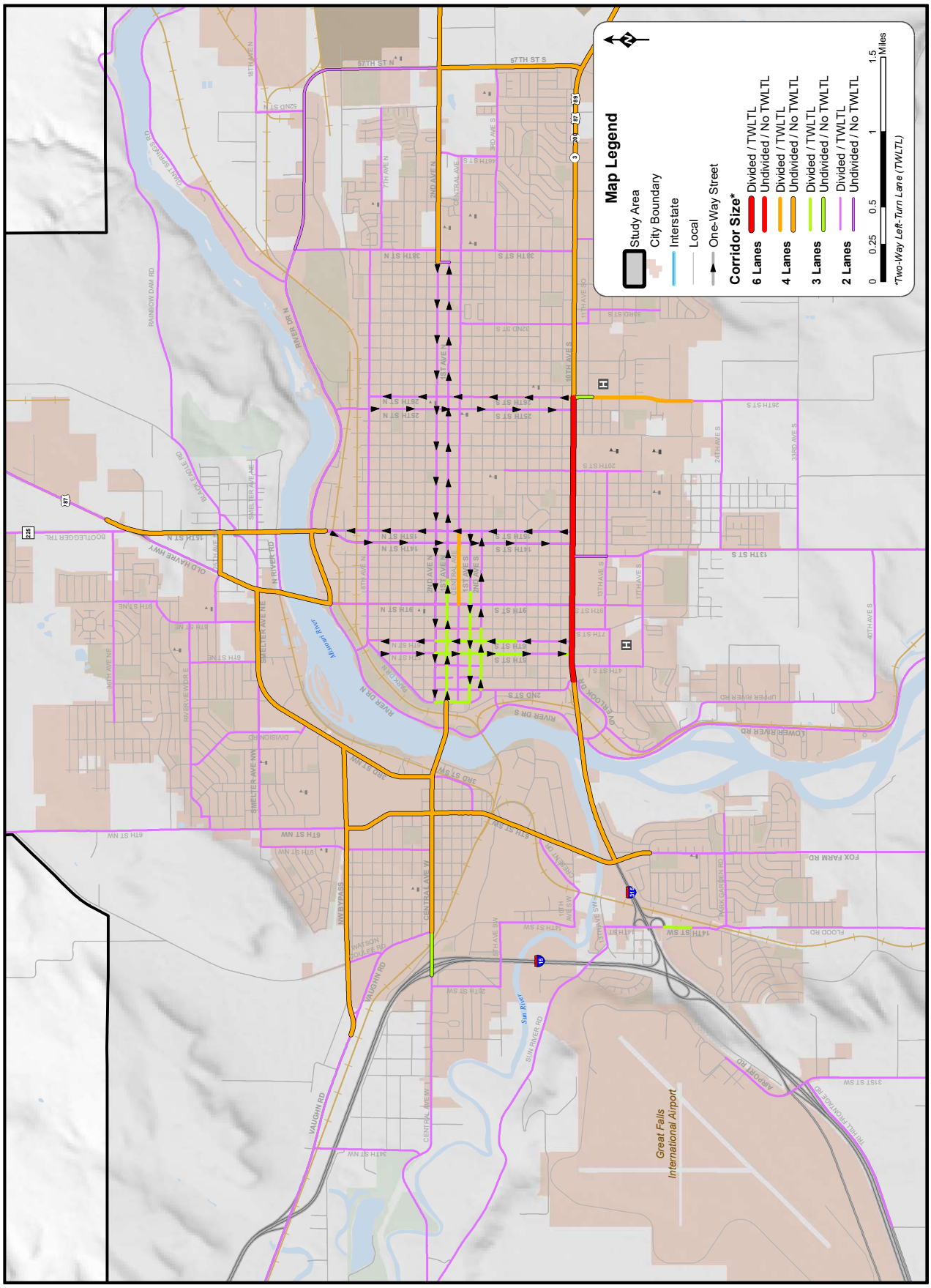
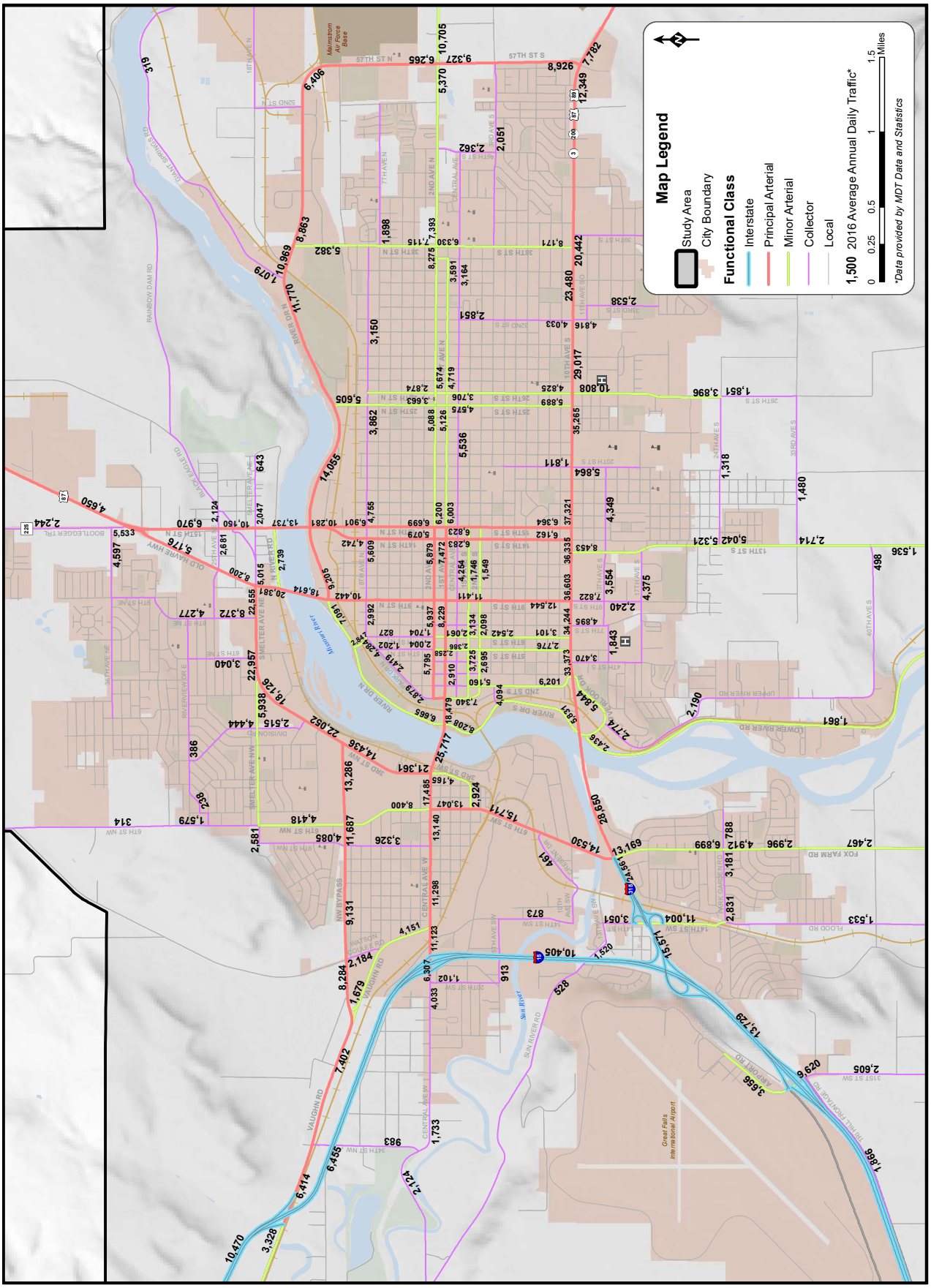


Figure 5: Existing Corridor Facility Size


Map Legend
Study Area
City Boundary
Functional Class
Interstate
Principal Arterial
Minor Arterial
Collector
Local
1,500 2016 Average Annual Daily Traffic*
0 0.25 0.5 1 1.5 Miles
*Data provided by MDT Data and Statistics
Malmstrom Air Force Base
Great Falls International Airport
Missouri River
Sun River
57TH ST S
38TH ST S
10TH AVE S
2ND AVE N
1ST AVE N
10TH AVE N
14TH ST S
20TH ST S
25TH ST S
38TH ST N
57TH ST N
VAUGHN RD
SUN RIVER RD
RIVER DR S
SMELTER AVE NW
SMELTER AVE NE
NW BYPASS
CENTRAL AVE W
9TH AVE SW
14TH ST SW
FRONTAGE RD
AIRPORT RD
FOX FARM RD
FLOOD RD
UPPER RIVER RD
LOWER RIVER RD
RAINBOW DAM RD
BOOTLEGGER TRL
OLD HAVRE HWY
BACK COULEE RD
OAKVIEW ESTATES RD
RIVERVIEW DR E
DIVISION RD
OX GARDEN RD
40TH AVE S
24TH AVE S
17TH AVE S
9TH AVE S
3RD AVE S
3RD AVE NW
2ND AVE NW
1ST AVE NW
10TH AVE NW
17TH AVE N
9TH AVE N
7TH AVE N
3RD AVE N
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40TH AVE S
3RD AVE S

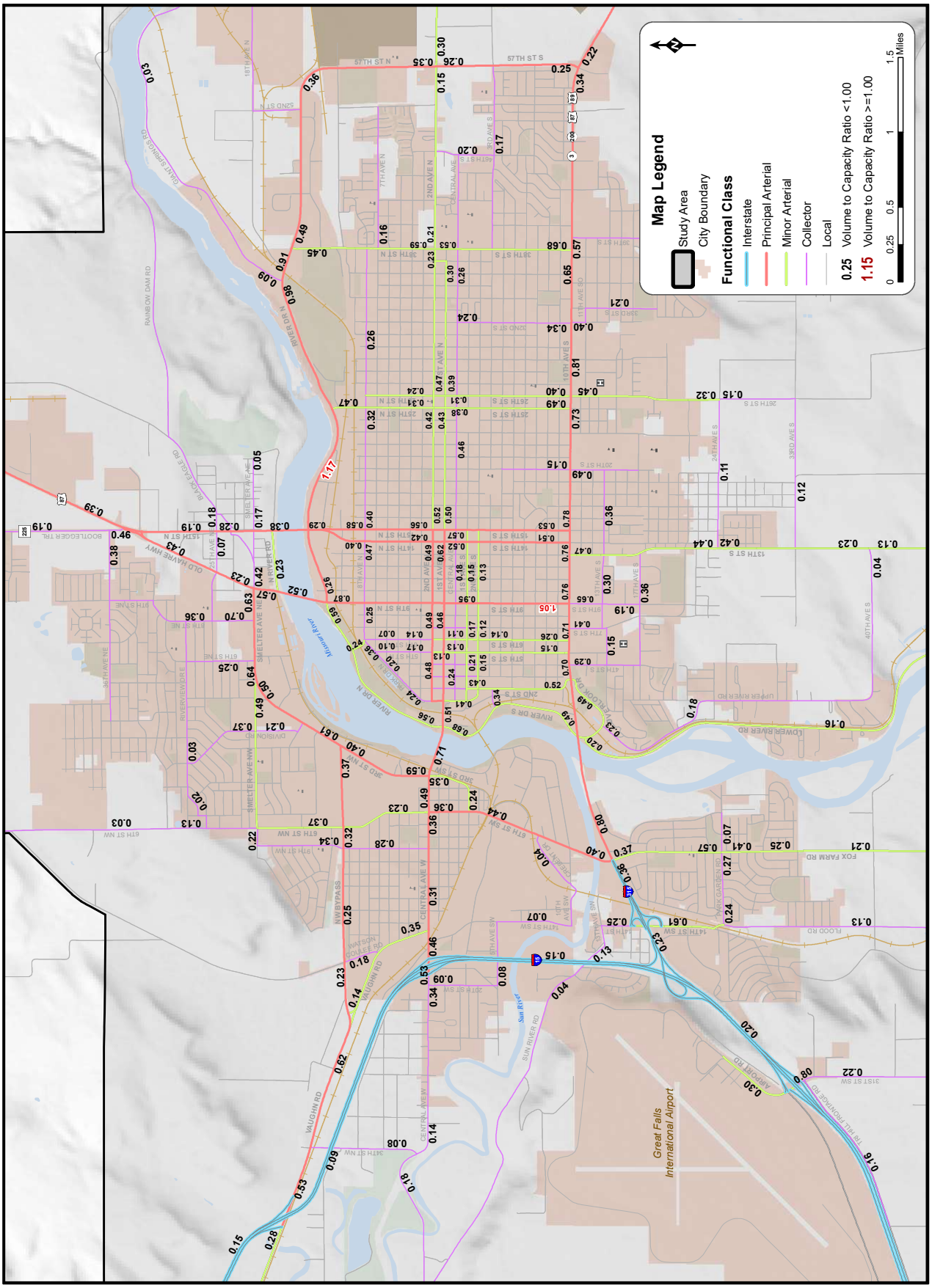


Figure 7: Existing Volume to Capacity Ratios

2.2.2. Intersection Operations

Urban road systems are ultimately controlled by the efficiency of the major intersections. High amounts of vehicle delay at major intersections directly reduces the number of vehicles that can be accommodated along the road during peak hours. As a result of this strong impact on corridor function, intersection improvements can usually be a cost-effective means of increasing a corridor's traffic volume capacity. In some circumstances, corridor expansion projects may be able to be delayed with targeted intersection improvements. Due to the significant portion of total expense for road construction projects used for project design, construction mobilization, and adjacent area rehabilitation, a careful analysis must be made of the expected service life from intersection improvements. If adequate design life can be achieved with only improvements to the intersections, then a corridor expansion may not be the most effective solution. With that in mind, it is important to determine how well the major intersections are functioning by evaluating their performance.

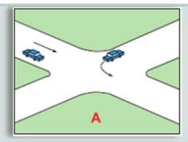
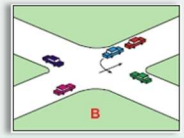
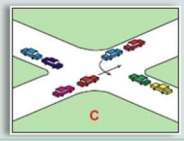
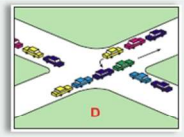
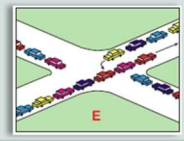
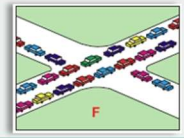
Intersection performance is evaluated in terms of vehicle delay. The amount of vehicle delay experienced at an intersection correlates to a measure called level of service (LOS). LOS is used as a means for identifying intersections that are experiencing operational difficulties, as well as a means for comparing multiple intersections. The LOS scale represents the full range of operating conditions. The scale is based on the ability of an intersection or street segment to accommodate the amount of traffic using the intersection. The scale ranges from "A" which indicates little, if any, vehicle delay, to "F" which indicates significant vehicle delay and traffic congestion. **Table 3** portrays a graphical representation of LOS.

The Transportation Research Board's *Highway Capacity Manual* (HCM) is the most widely used reference in determining the performance of existing roads and intersections, and for providing input into estimating future performance. As such, the HCM methods are implemented in the intersection operational analysis. Key inputs for the analysis include intersection layout, traffic volumes, traffic control, and signal timings. The observed volumes are adjusted by peak hour and seasonal adjustment factors and are used to calculate the ideal flow rate through the intersection. This flow rate helps calculate the true capacity of the intersection. With this information, total vehicle delay and LOS can be calculated for the intersection.

Data from various sources were compiled to display LOS for intersections in the study area. Intersections having poor operations or safety concerns were identified by the City as needing analysis and were therefore included herein. Data from recent corridor planning studies conducted by MDT (I-15 and River Drive Corridor Studies) were used to provide a more current LOS analysis than that provided in the 2014 LRTP. Additionally, there are count locations where more current (year 2016 or 2017) data is available, in these locations a new LOS analysis was performed using the updated turning movement counts. For many of the intersections counted for the 2014 LRTP there is no new data available, in which case the LOS calculations from the 2014 LRTP remained the same for the current LRTP.

In total, 50 intersections have been included in the LOS analysis. Of those intersections, 33 locations use the LOS data from the 2014 LRTP. An additional 14 locations were from the *River Drive Corridor Study* or the *I-15 Gore Hill to Emerson Junction Corridor Study*. There are only three locations where new data is available. Each intersection was analyzed for the peak hours, defined as 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM. **Figure 8** shows the intersections where peak hour turning movement counts are available.

Table 3: Intersection LOS Descriptions

LOS	Intersection	Signalized Delay (sec)	Unsignalized Delay (sec)	Description
A		<10	<10	• Free flow • Low Volumes • <1 vehicle in queue • **Signalized:** most vehicles do not stop • **Unsignalized:** Very easy to find acceptable gap
B		10-20	10-15	• Mostly free flow • Somewhat low Volumes • Occasionally 1+ vehicles in queue • **Signalized:** vehicles clear in one green phase • **Unsignalized:** Very easy to find acceptable gap
C		20-35	15-25	• Smooth flow • Moderate Volumes • Standing queue of at least 1 vehicle • **Signalized:** Individual cycle failures may occur • **Unsignalized:** Acceptable gaps found regularly
D		35-50	25-35	• Approaching unstable flow • High volume/capacity ratios • Standing queue of vehicles upon arrival • **Signalized:** Individual cycle failures are noticeable • **Unsignalized:** Hard to find acceptable gap
E		50-80	35-50	• Unstable flow • Volumes at or near capacity • Standing queue of vehicles upon arrival • **Signalized:** Individual cycle failures are frequent • **Unsignalized:** Hard to find acceptable gap
F		>80	>50	• Saturation condition • Volumes over capacity • Standing queue of vehicles upon arrival • **Signalized:** Many individual cycle failures • **Unsignalized:** Very hard to find acceptable gap

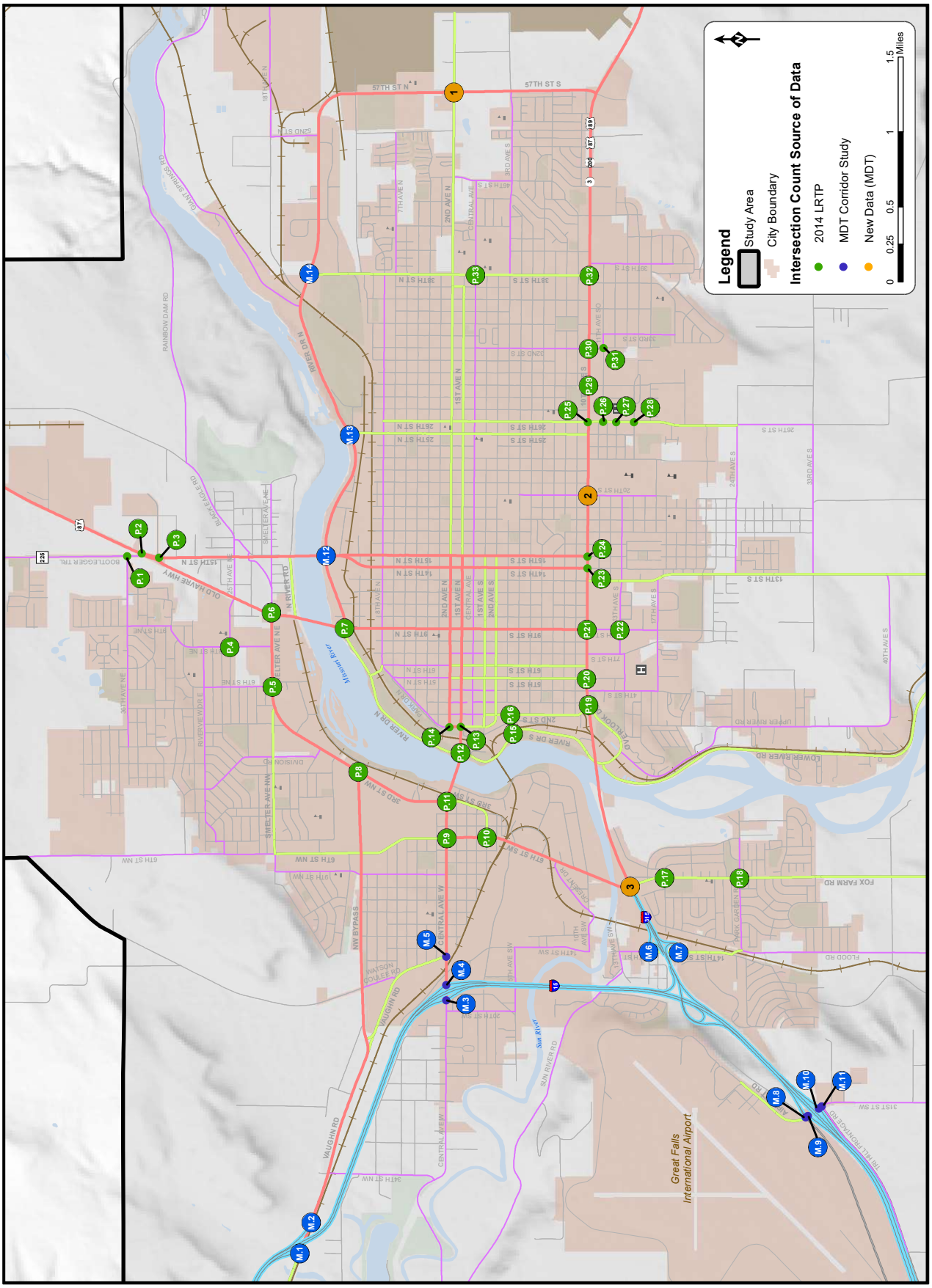


Figure 8: Intersection Count Locations

For signalized intersections, the LOS is based on the average stopped delay per vehicle. The relationship between LOS and average stopped delay per vehicle is shown in **Table 3**. The procedures used to evaluate signalized study intersections use detailed information on geometry, lane use, signal timing, peak hour volumes, arrival types, and other parameters. An intersection is determined to be functioning adequately if it is operating at LOS C or better.

LOS for two-way stop (TWS) controlled intersections are based on the delay experienced by each individual movement within the intersections, rather than on the average stopped delay per vehicle at the intersection. This difference from the method used for signalized intersections is necessary since the operating characteristics of a stop-controlled intersection are substantially different. Driver expectation and perceptions are entirely different. For two-way stop-controlled intersections, the through traffic on the major (uncontrolled) street experiences little to no delay at the intersection. Conversely, vehicles turning left from the minor street experience more delay than other movements and at times can experience significant delay. Vehicles on the minor street which are turning right or going across the major street generally experience less delay than those turning left from the same approach. Due to this situation, the intersection LOS is based on the average delay incurred at the worst performing movement.

For all-way stop (AWS) controlled intersections, LOS is based on average vehicle delay experienced at the intersection since all approaches are given similar opportunity to move through the intersection. This methodology is similar to that of signalized intersections.

Table 4 presents the intersection LOS and average vehicle delay during the AM and PM peak hours. The existing intersection LOS is also shown in **Figure 9**. Detailed results are provided in **Appendix B**.

Table 4: Existing Intersection LOS

ID	Intersection	Control Type	AM Peak Hour		PM Peak Hour	
			Delay (Sec)	LOS	Delay (Sec)	LOS
Intersections with New Count Data Available						
1	2nd Avenue N / 57th Street N	Signalized	21.0	C	21.7	C
2	10th Avenue S / 20th Street S	Signalized	14.2	B	21.9	C
3	10th Avenue S / Fox Farm Road	Signalized	37.6	D	49.7	D
Intersections Counted for MDT Corridor Studies						
M.1	I-15 SB / Vaughn Road	TWS	10.1	B	10.1	B
M.2	I-15 NB / Vaughn Road	TWS	7.3	A	7.3	A
M.3	I-15 SB Ramps / Central Avenue W	TWS	28.0	D	42.0	E
M.4	I-15 NB Ramps / Central Avenue W	TWS	19.9	C	29.1	D
M.5	Vaughn Road / Central Avenue W	TWS	27.1	D	65.0	F
M.6	14th Street SW / I-315 WB	Signalized	23.0	C	19.4	B
M.7	14th Street SW / I-315 EB	Signalized	14.4	B	13.0	B
M.8	I-15 SB Off Ramp / Airport Drive	TWS	12.7	B	35.5	E
M.9	I-15 SB On Ramp / Airport Drive	TWS	8.6	A	11.0	B
M.10	I-15 NB Ramps / Airport Drive	TWS	16.9	C	55.4	F
M.11	Tri Hill Frontage Rd / Airport Drive	TWS	13.5	B	14.5	B
M.12	River Drive N / 15th Street N	Signalized	37.5	D	31.3	C
M.13	River Drive N / 25th Street N	TWS	31.4	D	92.7	F
M.14	River Drive N / 38th Street N	Signalized	8.6	A	8.3	A
Intersections Counted in 2014 LRTP						
P.1	36th Avenue NE / Bootlegger Trail	TWS	13.4	B	14.5	B
P.2	Bootlegger Trail / U.S. 87	TWS	15.4	C	47.8	E
P.3	Old Havre Highway / 15th Street N	TWS	20.3	C	18.1	C

ID	Intersection	Control Type	AM Peak Hour		PM Peak Hour	
			Delay (Sec)	LOS	Delay (Sec)	LOS
P.4	25th Avenue NE / 8th Street NE	TWS	47.2	E	32.1	D
P.5	Smelter Avenue / 6th Street NE	Signalized	12.9	B	10.4	B
P.6	Smelter Avenue / 10th Street NE	Signalized	58.2	E	70.3	E
P.7	River Drive N / 9th Street N	Signalized	25.3	C	29.6	C
P.8	NW Bypass / 3rd Street NW	Signalized	12.3	B	14.2	B
P.9	Central Avenue NW / 6th Street NW	Signalized	22.4	C	25.4	C
P.10	6th Street SW / 4th Avenue SW	TWS	18.1	C	48.3	E
P.11	Central Avenue W / 3rd Street NW	Signalized	31.5	C	37.8	D
P.12	River Drive N / 1st Avenue N	Signalized	30.2	C	109.1	F
P.13	Park Drive N / 1st Avenue N	Signalized	14.9	B	20.2	C
P.14	Park Drive N / 2nd Avenue N	TWS	60.7	F	221.3	F
P.15	River Drive S / 3rd Avenue S	TWS	12.7	B	44.4	E
P.16	2nd Street S / 3rd Avenue S	TWS	12.3	B	24.6	C
P.17	Fox Farm Road / 18th Avenue SW	TWS	328.8	F	27.4	D
P.18	Fox Farm Road / Park Garden Road	TWS	48.2	E	20.5	C
P.19	10th Avenue S / 2nd Street S	Signalized	20.4	C	36.9	C
P.20	10th Avenue S / 5th Street S	Signalized	14.0	B	28.0	C
P.21	10th Avenue S / 9th Street S	Signalized	15.3	B	25.4	C
P.22	13th Avenue S / 9th Street S	AWS	15.5	C	25.4	D
P.23	10th Avenue S / 14th Street S	Signalized	17.9	B	21.2	C
P.24	10th Avenue S / 15th Street S	Signalized	7.1	A	12.6	B
P.25	10th Avenue S / 25th Street S	Signalized	19.4	B	24.1	C
P.26	11th Avenue S / 26th Street S	TWS	24.2	C	16.3	C
P.27	13th Avenue S / 26th Street S	TWS	12.7	B	16.3	C
P.28	15th Avenue S / 26th Street S	TWS	15.7	C	16.7	C
P.29	10th Avenue S / 29th Street S	TWS	97.7	F	87.4	F
P.30	10th Avenue S / 32nd Street S	Signalized	18.3	B	25.9	C
P.31	32nd Street S / 11th Avenue S	TWS	13.7	B	14.8	B
P.32	10th Avenue S / 38th Street S	Signalized	16.7	B	19.2	B
P.33	38th Street / Central Avenue	AWS	19.1	C	18.3	C

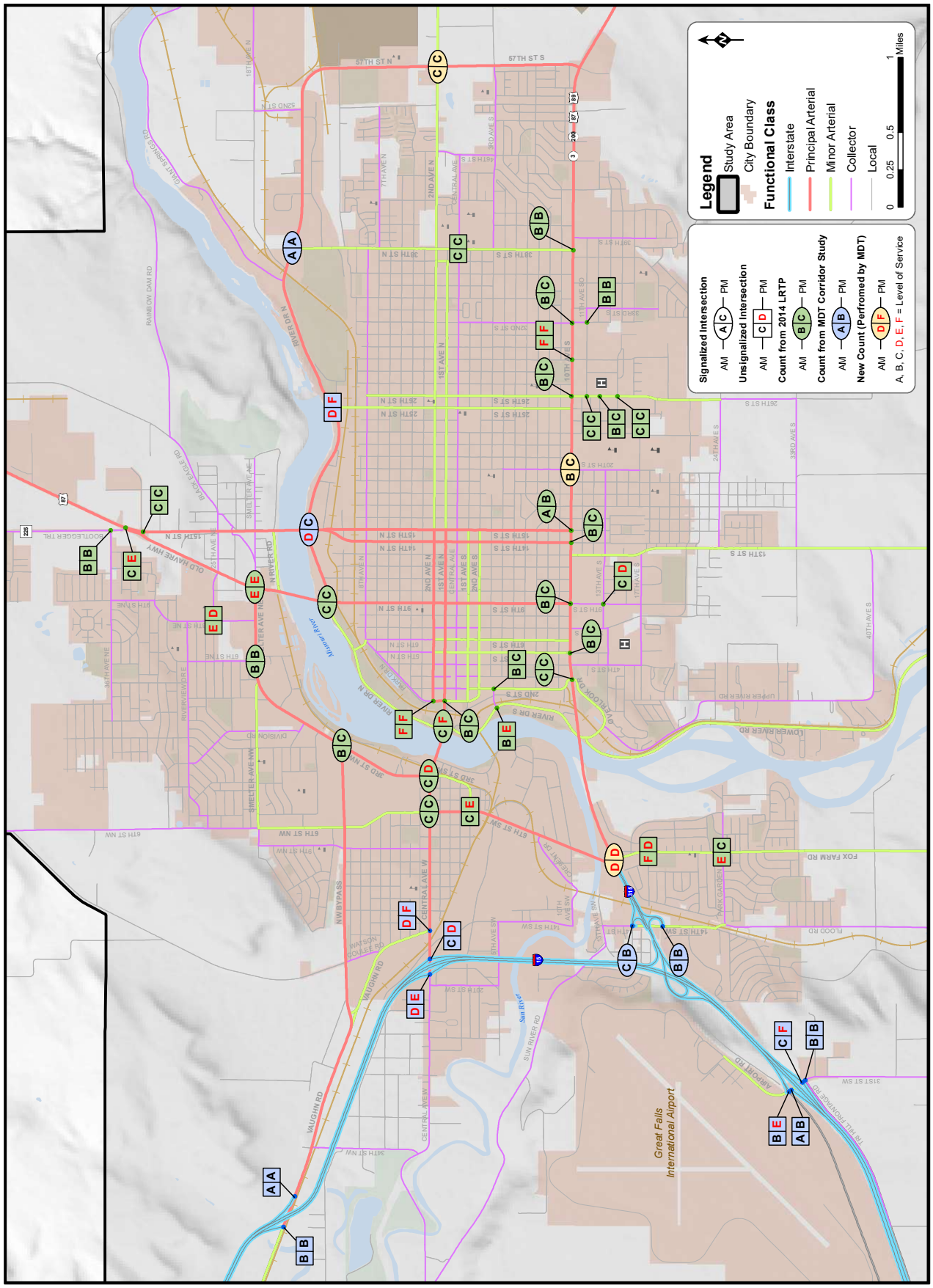


Figure 9: Existing Intersection Level of Service

2.2.3. Active Transportation Data

Providing an accurate picture of pedestrian and bicycle activity within any community is difficult. Data are typically not available or not comprehensive enough to form a complete picture of active transportation behavior. Data for vehicles is, by comparison, much more readily available. The following subsections summarize available data pertaining to active transportation.

JOURNEY TO WORK/COMMUTING (ACS)

The US Census has long been one of the only readily available sources of data to measure general levels of transportation choices. The data are limited to commute based trips and do not reflect the spectrum of potential trip types available. The American Community Survey (ACS) has supplemented the 10-year cycle of the US Census to provide additional annual data. For communities the size of Great Falls, annual data are not statistically valid, therefore five-year averages are used. This method provides some insight; however, it is slow to note changes over time. **Figure 10** provides a comparison of commuting modes in Montana's largest communities.

BICYCLING

Five-year ACS averages show that approximately 0.5 percent of commuters choose to travel to and from work by bicycle in Great Falls. This is similar to the 0.5 percent when measured during the 2000 Census. When compared to the rest of the United States, this figure is lower than the average, (0.6 percent) but is less than Montana's average mode share for bicycling to work (1.4 percent). In comparison to other major cities in Montana, Great Falls has fewer bike-to-work commuters than all other large Montana cities.

WALKING

About 3.1 percent of commuters in Great Falls walk to and from work. This is higher than the national (2.8 percent) and state (5.1 percent) averages, and the same as the 2000 Census when 3.1 percent of commuters walked. Compared to the other major cities in Montana, Great Falls has fewer bike-to-work commuters than Billings, Missoula, Bozeman, and Helena but outperforms Butte and Kalispell.

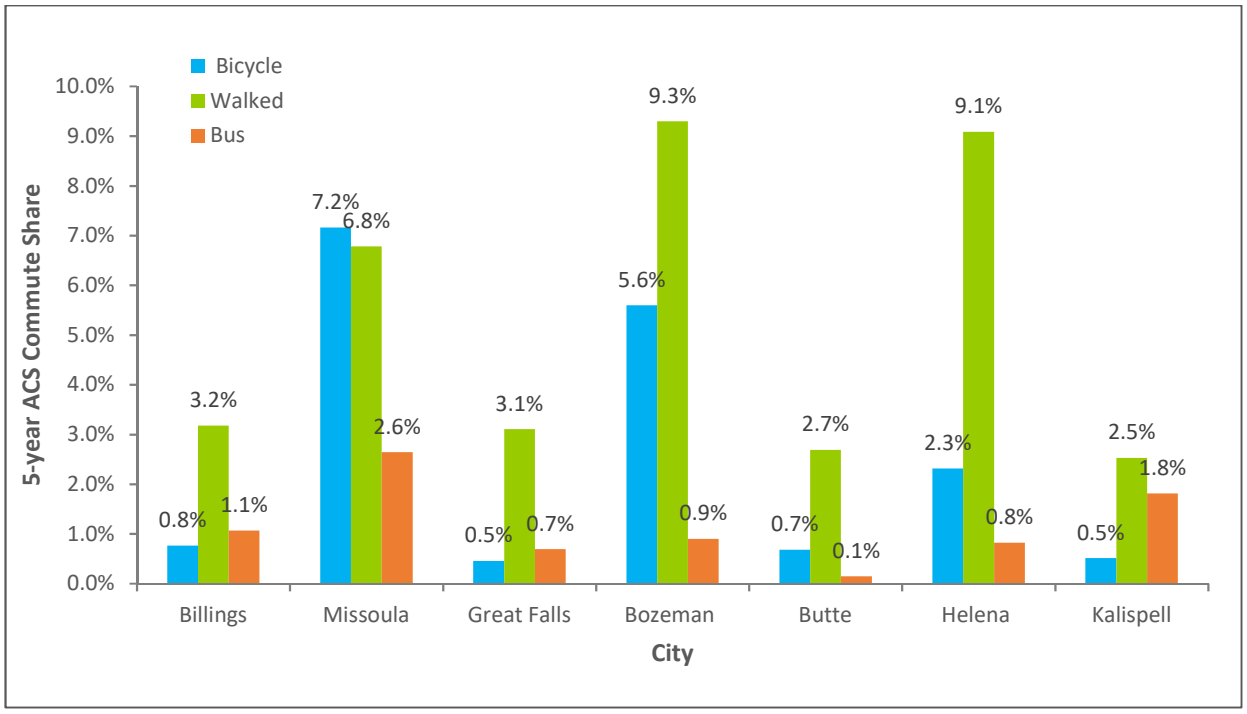


Figure 10: 5 Year ACS Commute Share of Seven Largest Montana Cities

ALL TRIPS (NHTS)

Data from the National Household Travel Survey (NHTS) provides mode share data aggregated at the national level for all trips and not just commute to work trips. For example, NHTS indicates that for every bike to work trip, there are another 1.6 utilitarian bike trips (shopping, personal trips, transporting others, medical or dental visits, meals, or other reasons), 0.5 bike to school trips, and 4.8 social or recreational trips. Overall bike to work trips represent only approximately 7.5 percent of all bike trips nationally. It should be noted that approximately 41 percent of bike trips counted by NHTS are return home trips, indicating many bicyclists perform the initial part of their round trip by other means. **Figure 11** provides a comparison of NHTS data for Montana's largest cities.

BICYCLING

Bicycle mode share for all trips in Great Falls is estimated at 1.4 percent, which is higher than the national average (1.0 percent) but lower than the statewide average for Montana (2.5 percent). In comparison to other Montana cities, Great Falls' total bicycle mode share is higher than Billings and Butte, but lower than the other four larger cities highlighted.

WALKING

An estimated 5.5 percent of all trips in Great Falls are walking trips, which is much higher than the ACS data outlining walking to and from work (2.7 percent), but it still remains lower than all six Montana cities in the graph and also lower than the national (6.1 percent) and Montana (10.6 percent) averages.

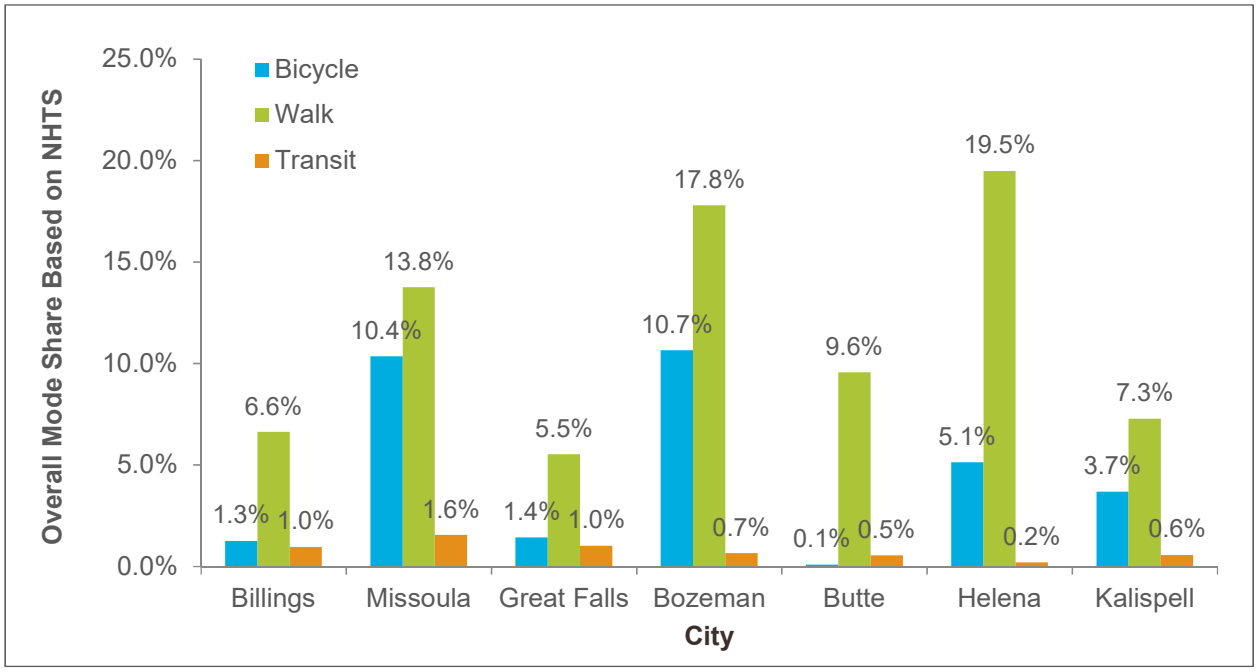


Figure 11: Overall Mode Share Based on NHTS of Seven Largest Montana Cities

3.0 PROJECTED TRANSPORTATION CONDITIONS

An analysis of the projected transportation system was performed to estimate how traffic patterns and characteristics may change from the existing conditions in the future. The inputs for this analysis include known existing conditions and anticipated land development expected to occur out to the year 2038. Provided in this section is a description of the traffic modeling effort that was conducted to forecast future travel conditions. The results of the model were used to identify areas of the transportation system where growth and congestion may occur due to forecasted development.

3.1. Travel Demand Model Development

A travel demand model was developed by MDT for Cascade County. The model was developed using *TransCAD* software. The model used a combination of information from the Census Bureau, GeoResults, Department of Labor and Industry, and Cascade County. The model was developed to represent 2015 baseline traffic conditions. A comparison of the model to known 2015 traffic data was performed to validate the model. The model was adjusted and calibrated to best represent 2015 conditions.

After developing the baseline 2015 model, future conditions were developed to evaluate the planning year 2038. Housing units and employment were added to census blocks to distribute growth that is projected to occur out to the year 2038. Known roadway infrastructure projects expected to be constructed within the next five years ("committed" projects) were also included as part of the 2038 future model.

One assumption that was built into the model is that traffic characteristics will remain similar to those that are seen today. Many factors can influence this assumption, such a fuel prices, technological advances, and other unknown circumstances. The model also assumes that the socioeconomic projections will be realized by the year 2038. Although projections are based upon local knowledge and past growth trends, they may not be completely accurate. Ultimately, the model for the projected conditions was used as a planning tool to help evaluate how traffic patterns might be affected by anticipated future development.

3.2. Projected Roadway Volumes and Capacity

Projected traffic volumes were estimated using the travel demand model. A comparison of the existing and projected conditions models was made to determine the percent change in traffic volume. The percent changes were then applied to known existing AADT count sites to estimate future daily traffic volumes. **Figures 12** and **13** show the projected AADT volumes and v/c ratios along the major street network, respectively. Note that the values shown in the figures assume that no changes to the transportation system will be made other than those currently committed to.

Additionally, to visualize where growth is projected to occur in Great Falls, and to aid in the planning process, a map of the projected traffic volume growth on the major street network was prepared. **Figure 14** shows where high traffic growth is expected to occur given the future land use assumptions made. The volumes shown are the difference between the volumes in the 2015 and 2038 travel demand models. In other words, the volumes shown represent additional traffic that could be added to the network should development occur in the manner projected. This visualization helps identify which roads may need additional investment to accommodate future growth. While some roads currently have little traffic volume and do not currently have capacity issues, future growth may greatly increase traffic volumes and could cause capacity issues if road improvements are not made.

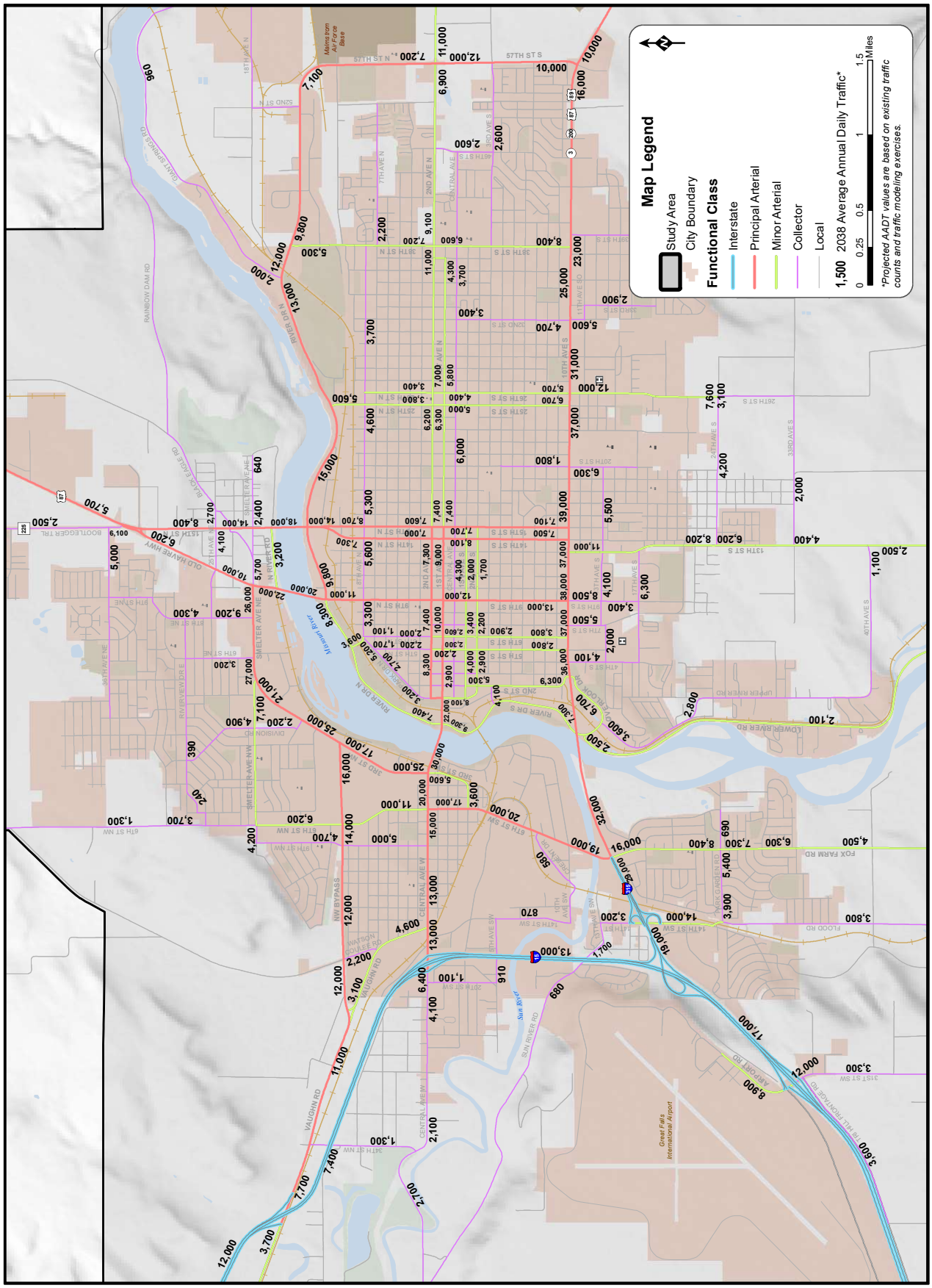


Figure 12: Projected Average Annual Daily Traffic

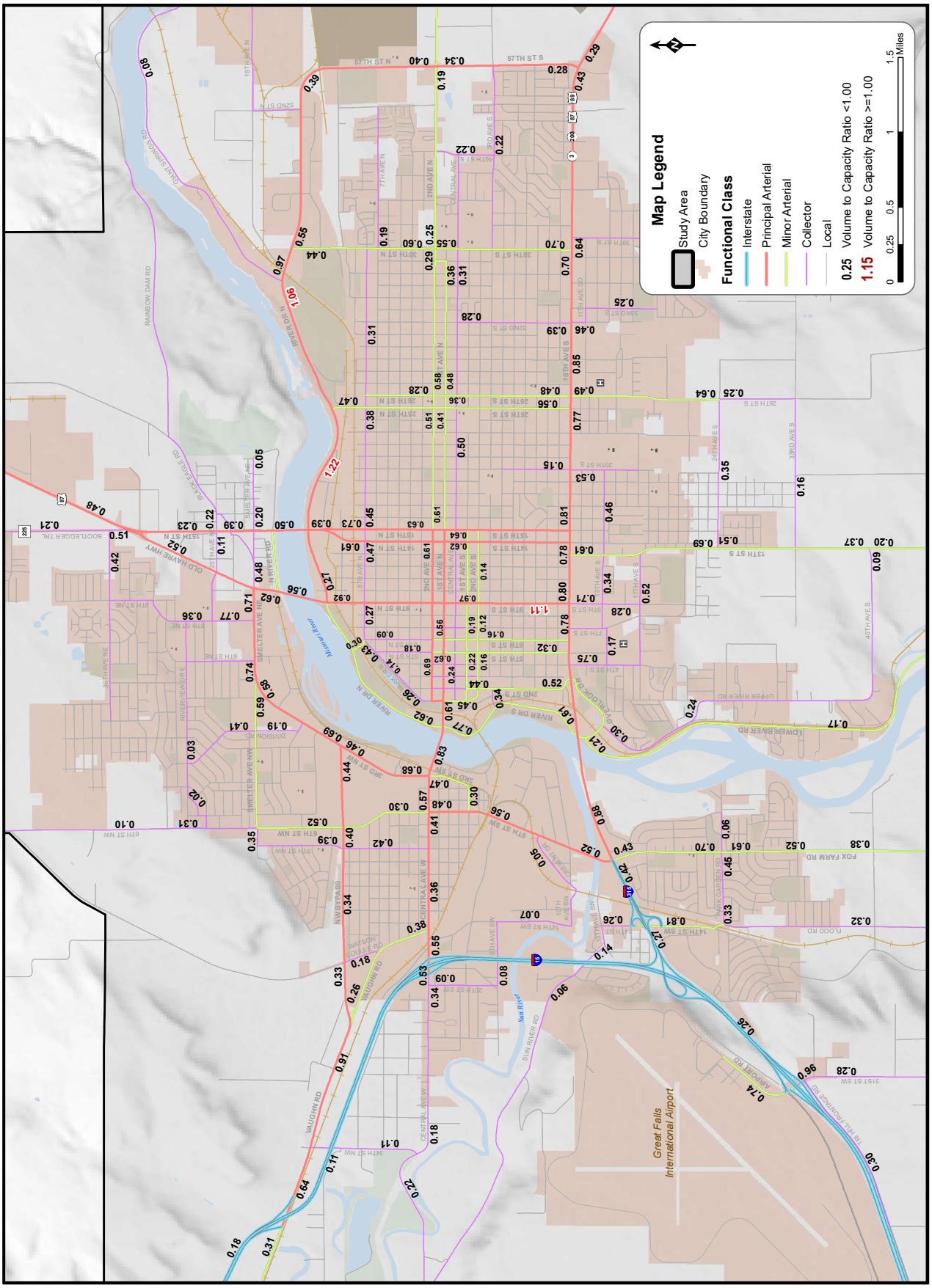


Figure 13: Projected Volume to Capacity Ratios

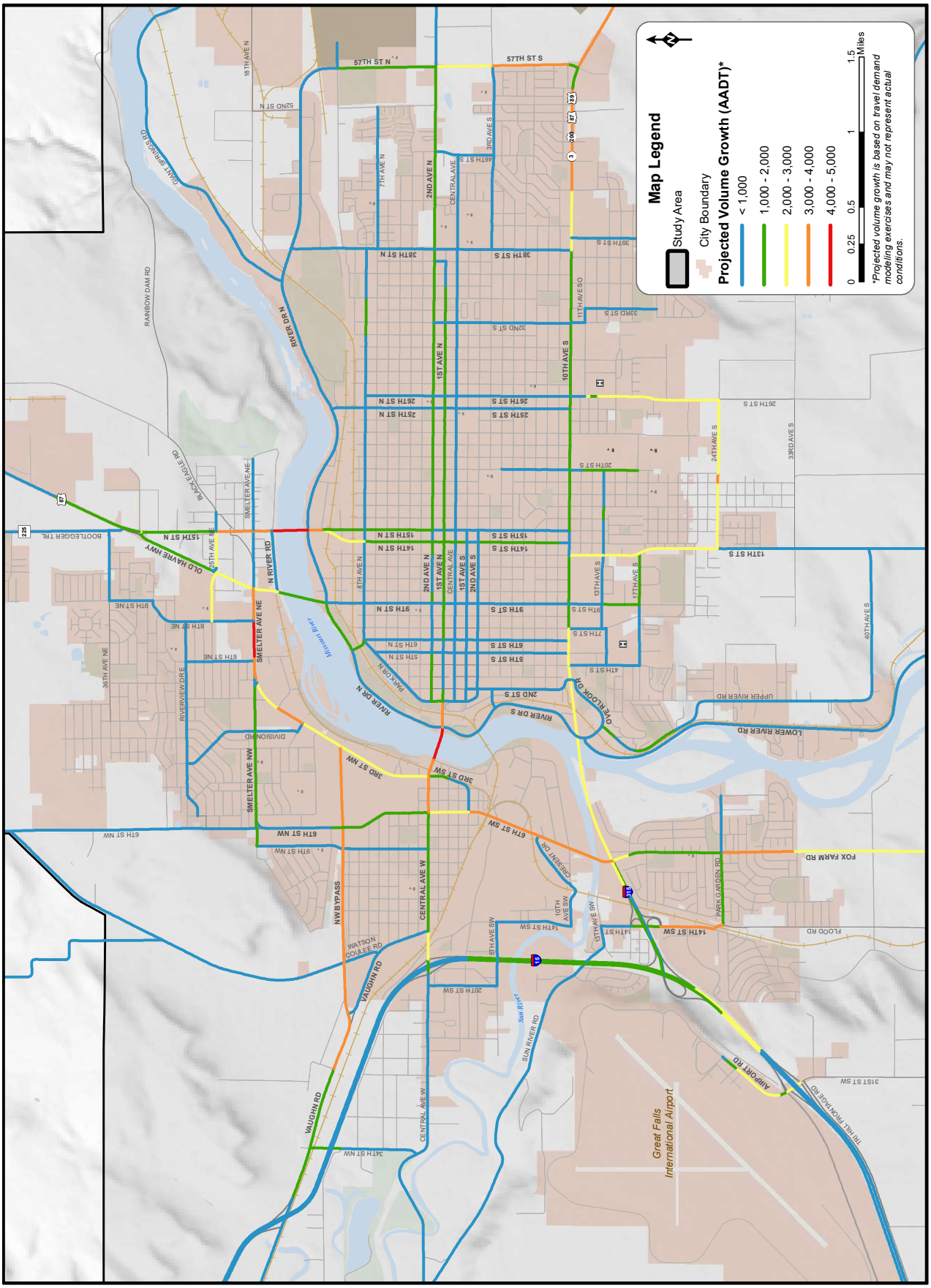


Figure 14: Projected Volume Growth

3.3. Projected Intersection Level of Service

Projections for intersection traffic volumes were made for the 50 intersections analyzed previously in **Section 2.2.2**. These projections were based on percent growth rates calculated from the travel demand model for the year 2038. A growth rate determined for the intersection as a whole was applied to each individual turning movement to represent projected conditions. The intersection LOS was calculated using the existing street layouts, lane-use configurations, and traffic control devices. The results of the analysis are shown in **Table 5** and **Figure 15**. More detailed information is provided in **Appendix C**.

Table 5: Projected Signalized Intersection LOS

ID	Intersection	Control Type	AM Peak Hour		PM Peak Hour	
			Delay (Sec)	LOS	Delay (Sec)	LOS
Intersections with New Count Data Available						
1	2nd Avenue N / 57th Street N	Signalized	21.6	C	22.3	C
2	10th Avenue S / 20th Street S	Signalized	13.8	B	27.5	C
3	10th Avenue S / Fox Farm Road	Signalized	45.6	D	80.4	F
Intersections Counted for MDT Corridor Studies						
M.1	I-15 SB / Vaughn Road	TWS	11.0	B	11.0	B
M.2	I-15 NB / Vaughn Road	TWS	7.3	A	7.4	A
M.3	I-15 SB Ramps / Central Avenue W	TWS	178.9	F	314.9	F
M.4	I-15 NB Ramps / Central Avenue W	TWS	113.1	F	445.2	F
M.5	Vaughn Road / Central Avenue W	TWS	406.0	F	1422.7	F
M.6	14th Street SW / I-315 WB	Signalized	22.2	C	19.6	B
M.7	14th Street SW / I-315 EB	Signalized	13.3	B	12.4	B
M.8	I-15 SB Off Ramp / Airport Drive	TWS	121.8	F	3138.9	F
M.9	I-15 SB On Ramp / Airport Drive	TWS	10.4	B	23.5	C
M.10	I-15 NB Ramps / Airport Drive	TWS	44.2	E	*OCB*	F
M.11	Tri Hill Frontage Rd / Airport Drive	TWS	27.3	D	43.7	E
M.12	River Drive N / 15th Street N	Signalized	58.7	E	58.3	E
M.13	River Drive N / 25th Street N	TWS	73.8	F	517.9	F
M.14	River Drive N / 38th Street N	Signalized	11.3	B	11.7	B
Intersections Counted in 2014 LRTP						
P.1	36th Avenue NE / Bootlegger Trail	TWS	139.1	F	358.8	F
P.2	Bootlegger Trail / U.S. 87	TWS	117.8	F	1105.0	F
P.3	Old Havre Highway / 15th Street N	TWS	181.2	F	171.8	F
P.4	25th Avenue NE / 8th Street NE	TWS	176.1	F	34.5	D
P.5	Smelter Avenue / 6th Street NE	Signalized	14.8	B	11.9	B
P.6	Smelter Avenue / 10th Street NE	Signalized	110.5	F	130.4	F
P.7	River Drive N / 9th Street N	Signalized	25.9	C	35.4	D
P.8	NW Bypass / 3rd Street NW	Signalized	17.3	B	58.5	E
P.9	Central Avenue NW / 6th Street NW	Signalized	24.5	C	30.1	C
P.10	6th Street SW / 4th Avenue SW	TWS	21.4	C	87.1	F
P.11	Central Avenue W / 3rd Street NW	Signalized	46.4	D	64.3	E
P.12	River Drive N / 1st Avenue N	Signalized	37.1	D	170.1	F
P.13	Park Drive N / 1st Avenue N	Signalized	16.3	B	23.4	C
P.14	Park Drive N / 2nd Avenue N	TWS	121.4	F	480.7	F
P.15	River Drive S / 3rd Avenue S	TWS	16.4	C	199.1	F
P.16	2nd Street S / 3rd Avenue S	TWS	12.8	B	32.6	D
P.17	Fox Farm Road / 18th Avenue SW	TWS	1382.0	F	379.2	F
P.18	Fox Farm Road / Park Garden Road	TWS	710.4	F	49.4	E
P.19	10th Avenue S / 2nd Street S	Signalized	21.4	C	63.9	E

ID	Intersection	Control Type	AM Peak Hour		PM Peak Hour	
			Delay (Sec)	LOS	Delay (Sec)	LOS
P.20	10th Avenue S / 5th Street S	Signalized	15.5	B	34.3	C
P.21	10th Avenue S / 9th Street S	Signalized	18.6	B	32.9	C
P.22	13th Avenue S / 9th Street S	AWS	16.6	C	31.0	D
P.23	10th Avenue S / 14th Street S	Signalized	19.7	B	24.6	C
P.24	10th Avenue S / 15th Street S	Signalized	8.1	A	17.1	B
P.25	10th Avenue S / 25th Street S	Signalized	21.4	C	24.9	C
P.26	11th Avenue S / 26th Street S	TWS	43.2	E	32.9	D
P.27	13th Avenue S / 26th Street S	TWS	20.4	C	37.9	E
P.28	15th Avenue S / 26th Street S	TWS	780.7	F	1430.0	F
P.29	10th Avenue S / 29th Street S	TWS	305.0	F	533.2	F
P.30	10th Avenue S / 32nd Street S	Signalized	21.8	C	36.9	D
P.31	32nd Street S / 11th Avenue S	TWS	15.5	C	17.3	C
P.32	10th Avenue S / 38th Street S	Signalized	19.3	B	27.0	C
P.33	38th Street / Central Avenue	AWS	19.1	C	15.7	C

OCB- Outside Computational Bounds of software

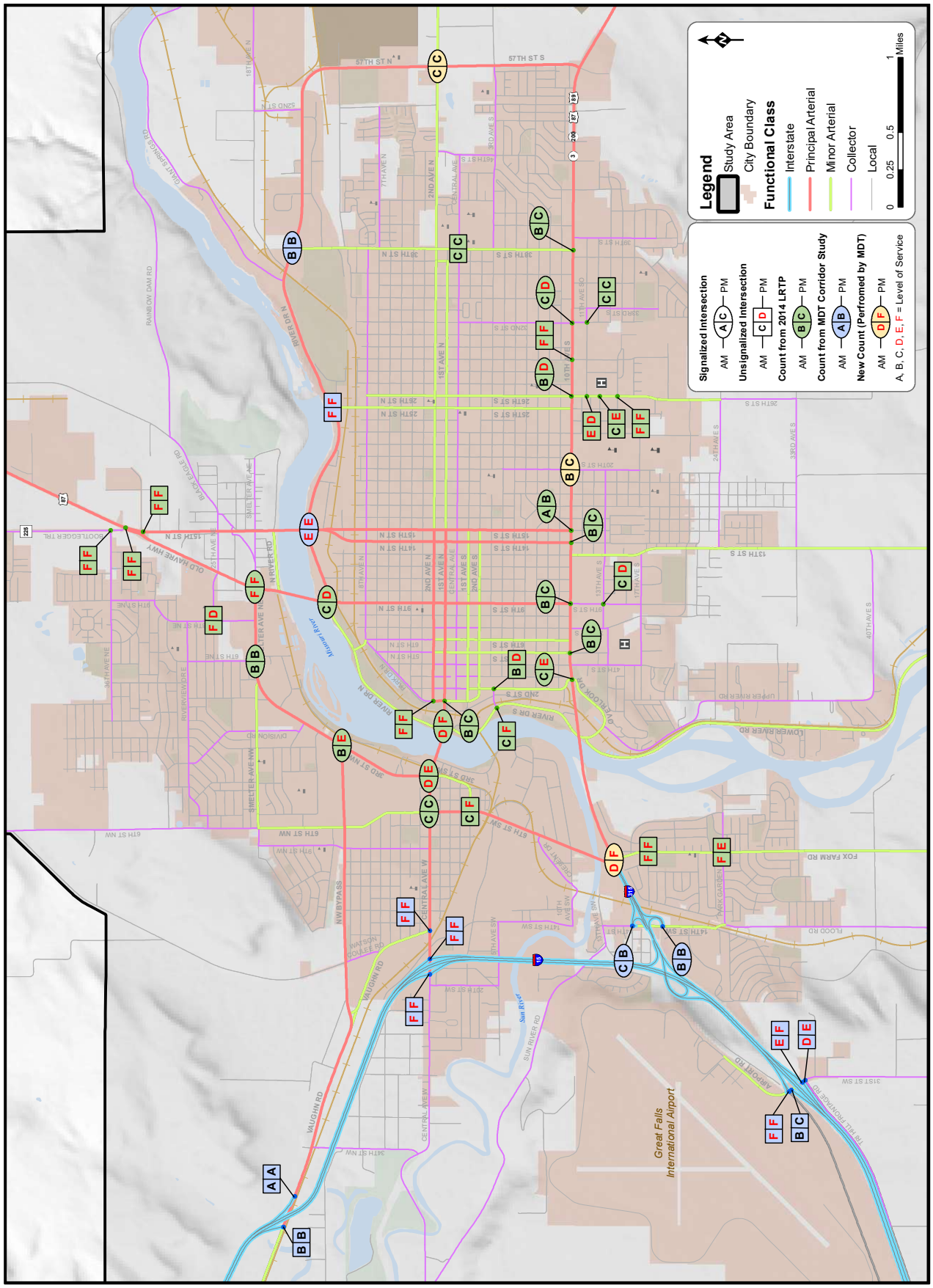


Figure 15: Projected Intersection Level of Service

4.0 SAFETY

Improving transportation safety requires more than just fixing a road or increasing police patrols. In order to be the most effective, safety improvements need to consider the "four E's" of transportation safety: Education, Enforcement, Engineering, and Emergency Services.

Crash data within the study area was analyzed to determine problem areas, "hot-spot" crash locations and behavioral characteristics. Trend analysis comparisons were also made for the City of Great Falls, Cascade County, and the State of Montana to help identify unique trends. The following sections provide an analysis of available crash data to help identify crash trends and contributing factors.

4.1. Study Area Crash Analysis

The MDT Traffic and Safety Bureau provided crash data for the five-year period from January 1st, 2012 to December 31st, 2016. The crash reports are a summation of information from the scene of the crash provided by the responding officer. As such, some of the information contained in the crash reports may be subjective.

According to the MDT crash database, there were 8,558 crashes reported within the study area during the analysis time period. The crash database was plotted spatially based on the XY coordinates recorded for each crash. **Figures 16** and **17** show the density of crashes within the study area based on the spatial data. Crash clusters are generally noted at intersections with the highest traffic volumes.

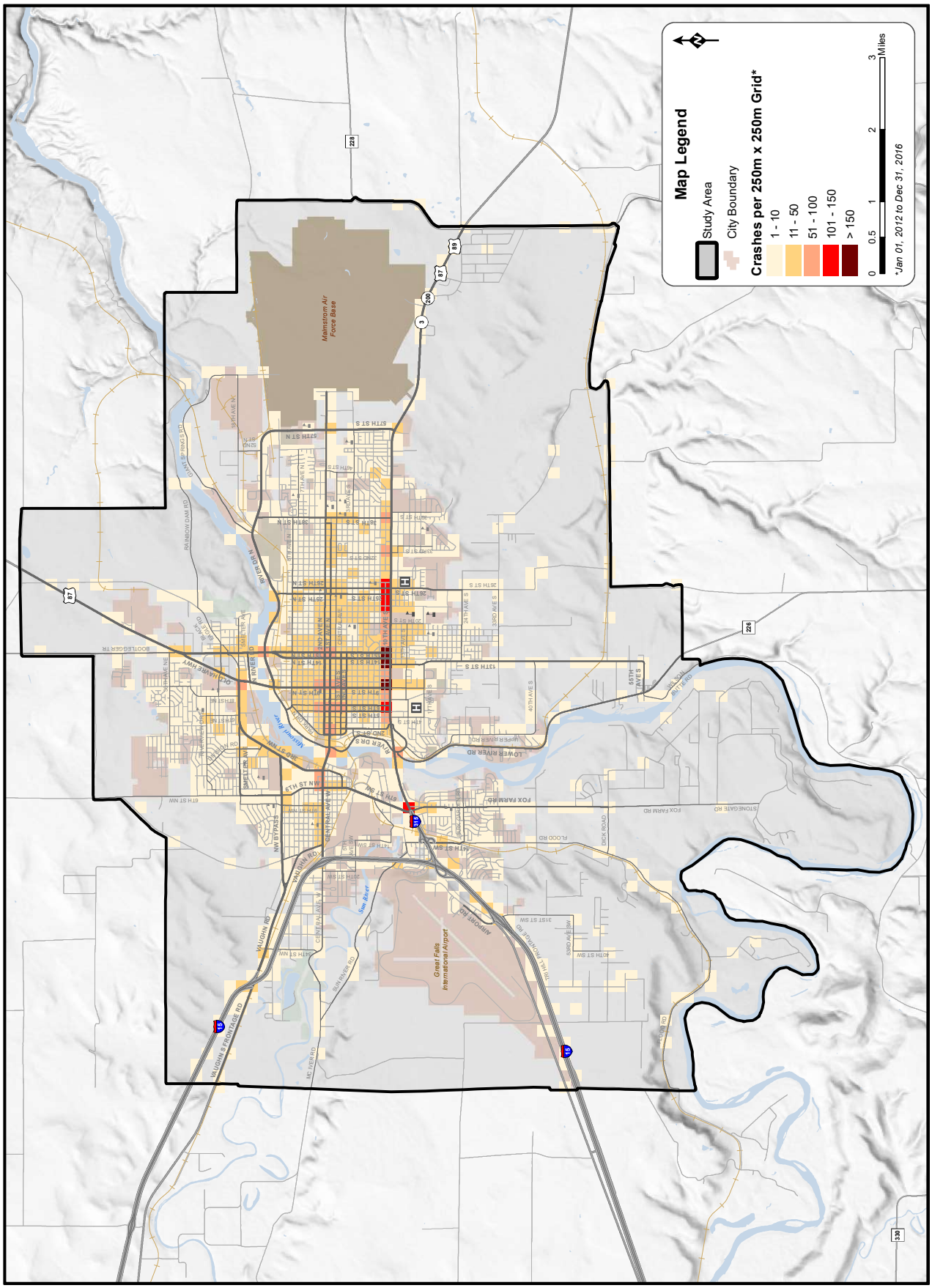


Figure 16: Crash Density

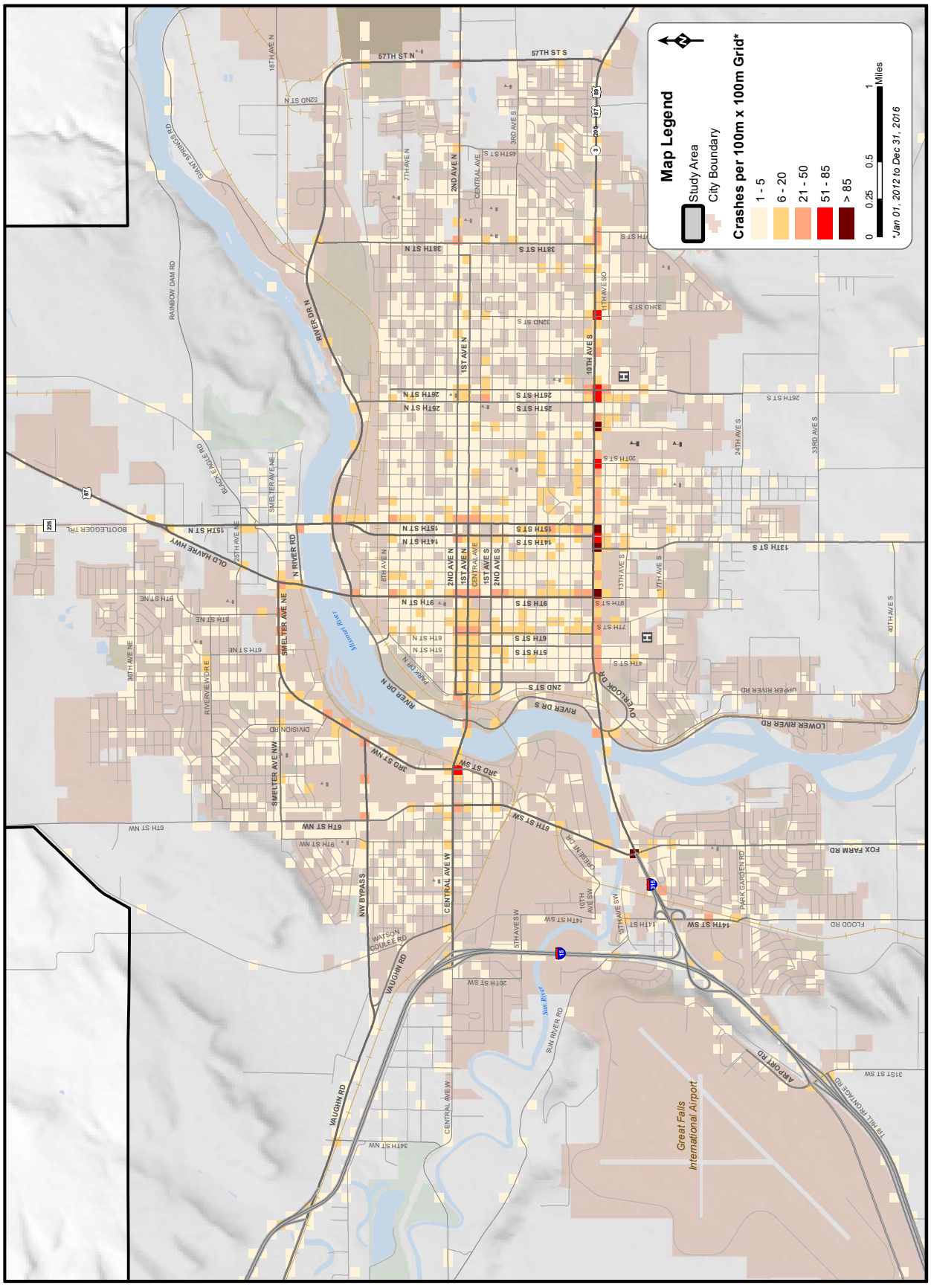


Figure 17: Crash Density (Detail Area)

4.1.1. Crash Period

Crash data for the study area was evaluated based on the period of time when the crash occurred. With regards to time of day, spikes in the number of crashes occur during the peak hours. Over 50 percent of crashes were reported between 12:00 PM and 6:00 PM. The PM peak hours (3:00 PM to 6:00 PM) accounted for approximately 31 percent of reported crashes.

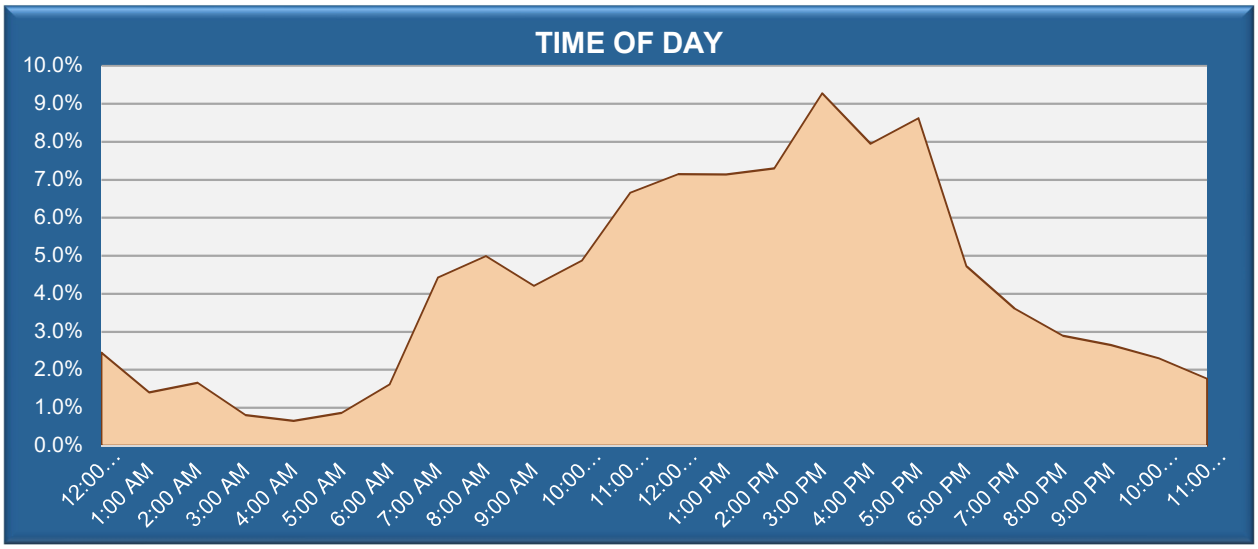


Figure 18: Crash Statistics for Time of Day

The most common month for crashes is December, followed by January and November. During these months, inclement weather conditions often exist which can contribute to an increase in the number of crashes. Traffic volumes also commonly increase during the month of December due to increased holiday related traffic. Over 78 percent of crashes occur on a weekday, with Friday being the most common day with 18.1 percent of crashes. The fewest number of crashes were reported on Sundays.

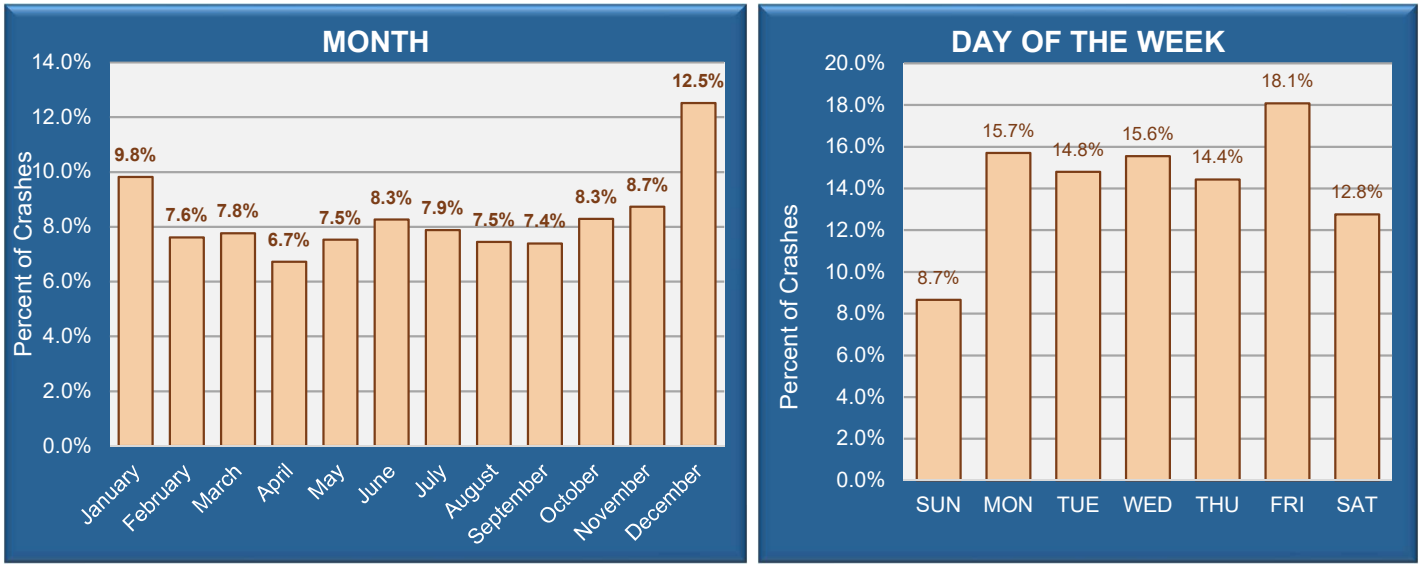


Figure 19: Crash Statistics for Month and Day of the Week

4.1.2. Environmental Factors

Crash data was reviewed to see if any trends exist related to environmental factors such as weather, roadway surfacing, and light conditions. Approximately 68 percent of the reported crashes occurred while road surfacing was dry while 31 percent occurred on wet, icy, snowy or slushy surfacing. Inclement weather conditions (i.e. rain, snow, sleet, or fog) were present for approximately 14 percent of crashes. Over 71 percent of reported crashes occurred during the daylight, while almost 17 percent were reported as under dark lighted conditions.

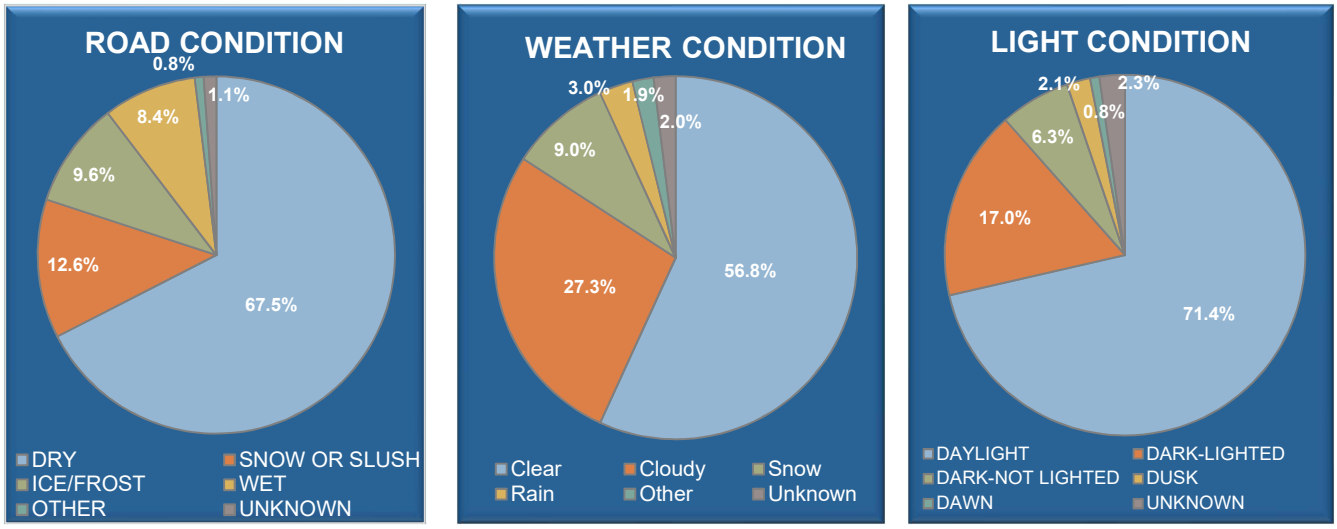


Figure 20: Crash Statistics for Environmental Factors

4.1.3. Crash Type

Almost 43 percent of crashes occurred at non-junction locations, while just over 50 percent of crashes occurred in an intersection or were related to an intersection. About 87 percent of crashes occurred on the roadway, while approximately 5 percent occurred on the shoulder. Single vehicle crashes accounted for just over 16 percent of crashes.

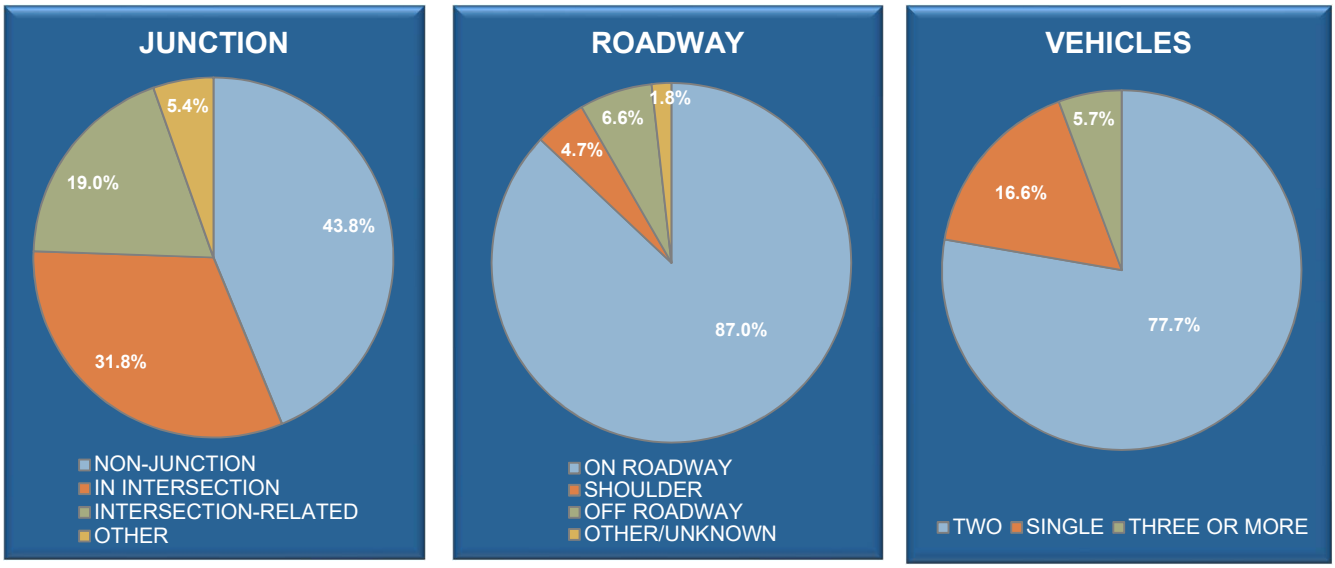


Figure 21: Crash Statistics for Location and Number of Vehicles

The most common manner of collision was rear-end crashes which accounted for approximately 28 percent of reported crashes. Right angle crashes and sideswipe crashes were the next most common manners of collision accounting for approximately 26 and 16 percent of crashes, respectively.

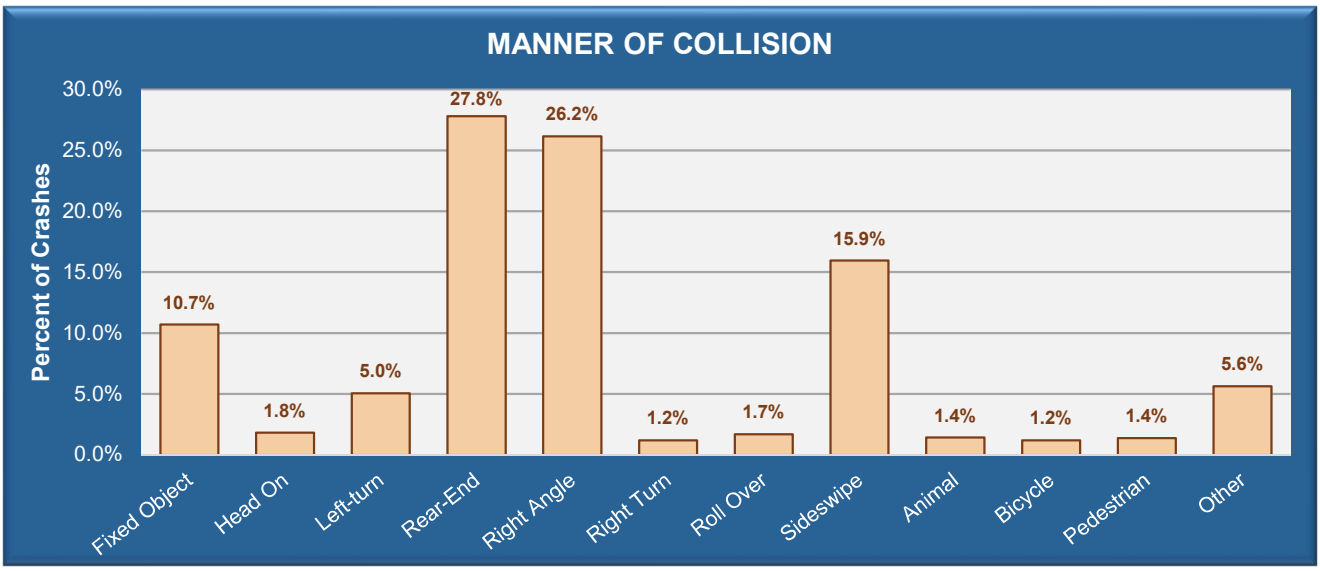


Figure 22: Crash Statistics for Collision Type

4.1.4. Crash Severity

Reported crashes are categorized by crash severity. The most severe injury defines the severity of the crash. For example, if a crash results in a fatality and an injury, the crash would be defined as a fatal crash. During the five-year analysis period, there were 1,860 injury crashes (22 percent) which resulted in 2,589 injuries. Of the injury crashes, 82 (1.0 percent) resulted in incapacitating injuries. In addition, there were 17 fatal crashes (0.2 percent) resulting in 19 fatalities.

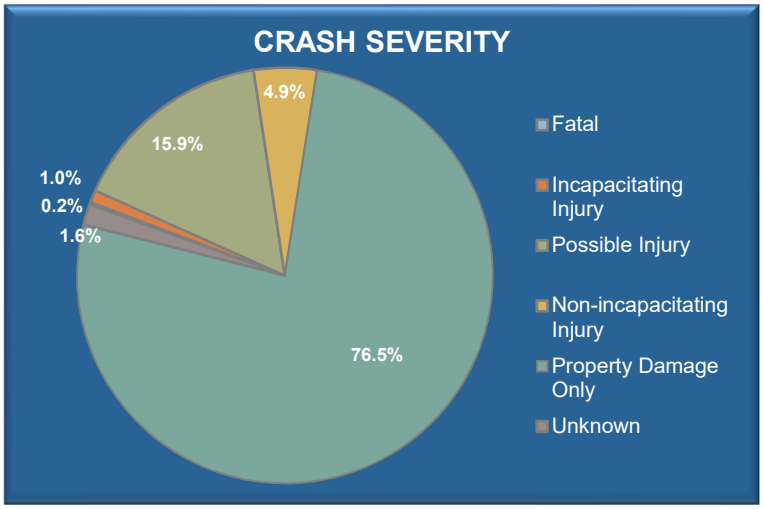


Figure 23: Crash Statistics for Severity

Figures 24 and **25** show the location of the crashes which resulted in incapacitating injuries and/or fatalities. An incapacitating injury is defined as an injury, other than a fatality, which prevents the injured person from walking, driving or normally continuing the activities they were capable of performing before the injury.

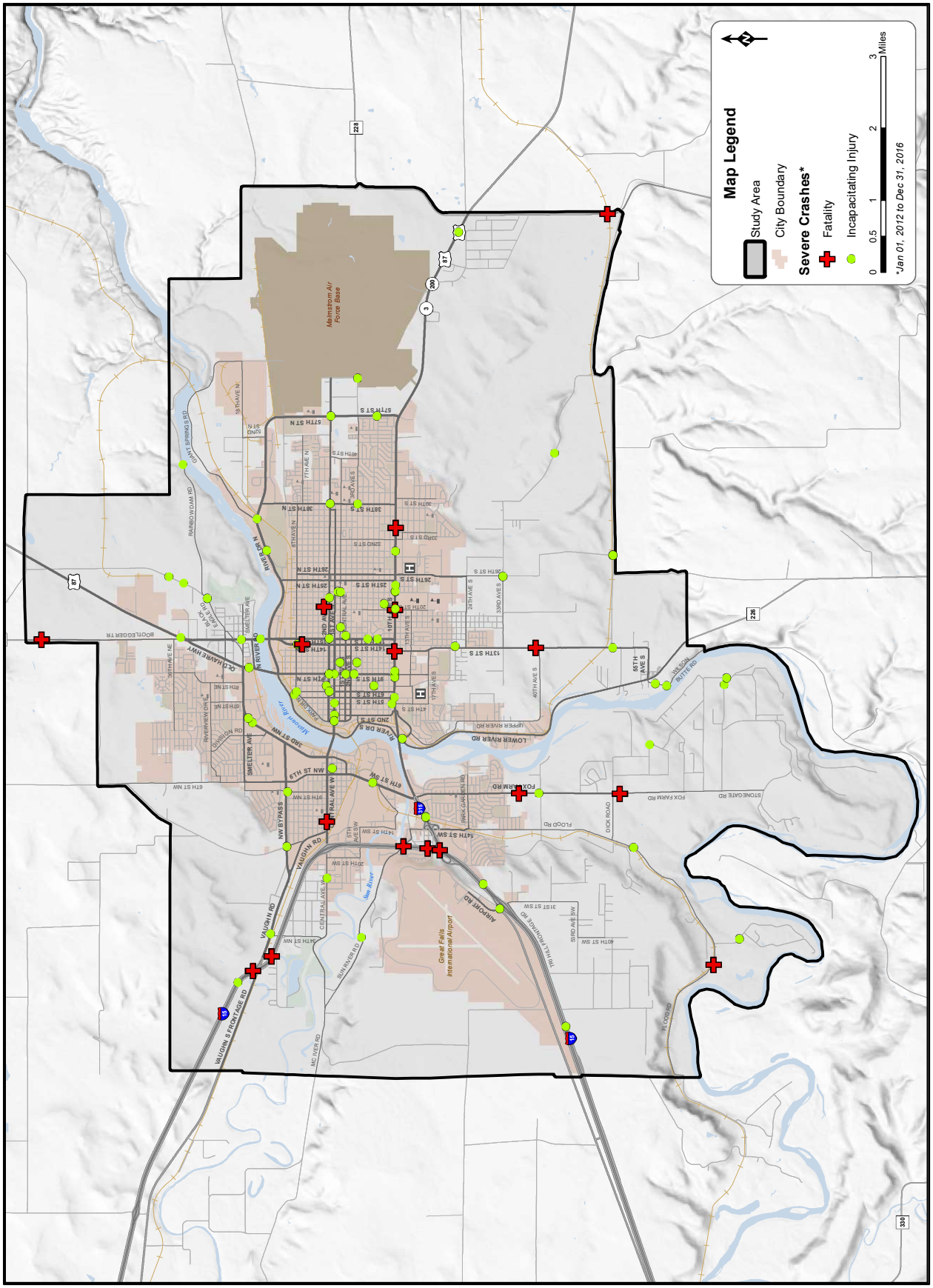


Figure 24: Severe Crash Locations

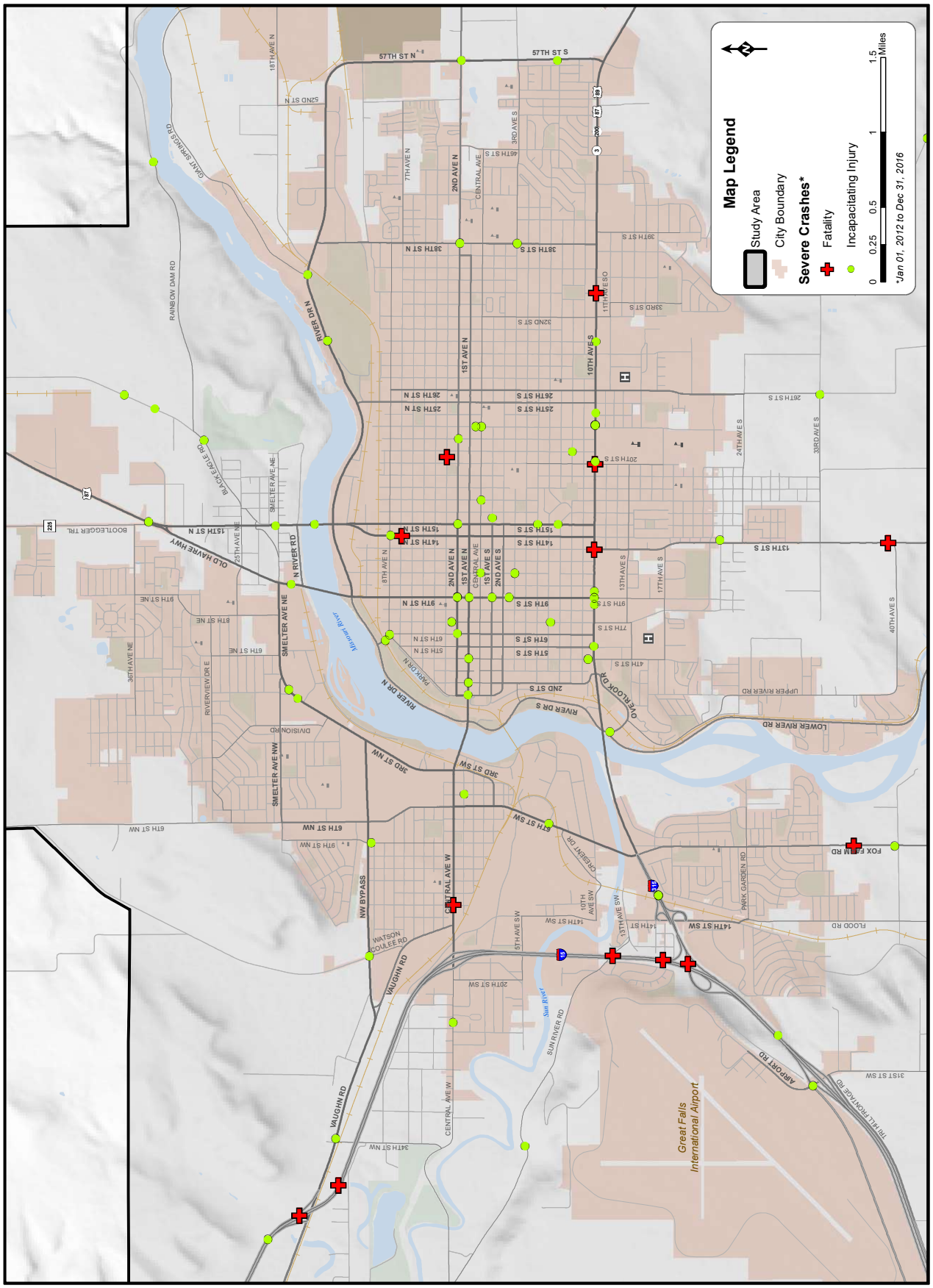


Figure 25: Severe Crash Locations (Detail Area)

4.1.5. Intersection Crashes

The 50 intersections that were studied for LOS were also evaluated for crash statistics. The crash information was analyzed to identify those intersections with crash characteristics that may warrant further study.

The number of crashes at each intersection was determined spatially from the GIS crash database. Any crash located within 150 feet was counted for that intersection. Intersection traffic volumes were determined from PM peak hour turning movement counts. A design hourly vehicle (DHV) factor of 9.42 percent was applied to the peak hour counts to estimate daily volumes based on MDT permanent count sites located within the study area.

The crash rate represents the number of crashes against the daily traffic volumes of the intersection. The rate is expressed as the number of crashes per million entering vehicles. The following equation is used to calculate crash rate:

$$\frac{Total\ Number\ of\ Crashes\ \times 1{,}000{,}000\ vehicles}{Vehicles\ per\ day \times Number\ of\ Years\ \times 365\ days/year} = Crash\ Rate$$

The severity index is calculated by applying multipliers to crashes based on severity. For the severity index, crashes were broken into three categories of severity: property damage only (PDO), non-incapacitating injury, and fatality or incapacitating injury crashes. Each of these three types is given a different multiplier: one (1) for PDO, three (3) for injury, and eight (8) for fatality or incapacitating injury crashes. The following equation is used to calculate severity index:

$$\frac{(\#PDO \times 1) + (\#Injury \times 3) + (\#Fatal\ or\ Incap \times 8)}{Total\ Number\ of\ Crashes} = Severity\ Index$$

The severity rate was determined by multiplying the crash rate by the severity index. **Table 6** lists the crash statistics for the studied intersections.

Table 6: Intersection Crashes

ID	Intersection	Total Crashes	Fatal	Incap. Injury	Injury	Crash Rate	Severity Index	Severity Rate
Intersections with New Count Data Available								
1	2nd Avenue N / 57th Street N	21	0	1	5	0.80	1.81	1.45
2	10th Avenue S / 20th Street S	63	1	1	19	0.82	1.83	1.51
3	10th Avenue S / Fox Farm Road	106	0	0	24	1.36	1.45	1.98
Intersections Counted for MDT Corridor Studies								
M.1	I-15 SB / Vaughn Road	5	0	0	1	1.04	1.40	1.46
M.2	I-15 NB / Vaughn Road	0	0	0	0	0.00	0.00	0.00
M.3	I-15 SB Ramps / Central Avenue W	1	0	0	1	0.06	3.00	0.19
M.4	I-15 NB Ramps / Central Avenue W	2	0	0	0	0.10	1.00	0.10
M.5	Vaughn Road / Central Avenue W	10	0	0	1	0.45	1.20	0.54
M.6	14th Street SW / I-315 WB	1	0	0	0	0.04	1.00	0.04
M.7	14th Street SW / I-315 EB	0	0	0	0	0.00	0.00	0.00
M.8	I-15 SB Off Ramp / Airport Drive	8	0	1	2	0.63	2.38	1.50
M.9	I-15 SB On Ramp / Airport Drive	2	0	0	1	0.17	2.00	0.34
M.10	I-15 NB Ramps / Airport Drive	5	0	0	1	0.31	1.40	0.44

ID	Intersection	Total Crashes	Fatal	Incap. Injury	Injury	Crash Rate	Severity Index	Severity Rate
M.11	Tri Hill Frontage Rd / Airport Drive	5	0	0	2	0.49	1.80	0.88
M.12	River Drive N / 15th Street N	39	0	0	10	0.77	1.51	1.17
M.13	River Drive N / 25th Street N	11	0	0	3	0.35	1.55	0.54
M.14	River Drive N / 38th Street N	7	0	0	1	0.28	1.29	0.37
Intersections Counted in 2014 LRTP								
P.1	36th Avenue NE / Bootlegger Trail	4	0	0	0	0.38	1.00	0.38
P.2	Bootlegger Trail / U.S. 87	7	0	1	0	0.37	2.00	0.74
P.3	Old Havre Highway / 15th Street N	11	0	0	6	0.64	2.09	1.33
P.4	25th Avenue NE / 8th Street NE	4	0	0	0	0.28	1.00	0.28
P.5	Smelter Avenue / 6th Street NE	3	0	0	0	0.07	1.00	0.07
P.6	Smelter Avenue / 10th Street NE	40	0	0	5	0.81	1.25	1.01
P.7	River Drive N / 9th Street N	41	0	0	13	1.03	1.63	1.68
P.8	NW Bypass / 3rd Street NW	35	0	0	13	0.79	1.74	1.37
P.9	Central Avenue NW / 6th Street NW	36	0	0	9	0.80	1.50	1.20
P.10	6th Street SW / 4th Avenue SW	12	0	0	0	0.44	1.00	0.44
P.11	Central Avenue W / 3rd Street NW	53	0	0	17	0.92	1.64	1.51
P.12	River Drive N / 1st Avenue N	44	0	0	7	1.17	1.32	1.54
P.13	Park Drive N / 1st Avenue N	20	0	1	7	0.31	2.05	0.63
P.14	Park Drive N / 2nd Avenue N	21	0	0	3	1.42	1.29	1.82
P.15	River Drive S / 3rd Avenue S	5	0	0	1	0.27	1.40	0.37
P.16	2nd Street S / 3rd Avenue S	2	0	0	0	0.12	1.00	0.12
P.17	Fox Farm Road / 18th Avenue SW	8	0	0	3	0.35	1.75	0.61
P.18	Fox Farm Road / Park Garden Road	4	0	0	1	0.22	1.50	0.33
P.19	10th Avenue S / 2nd Street S	20	0	0	8	0.29	1.80	0.53
P.20	10th Avenue S / 5th Street S	54	0	1	12	0.76	1.57	1.20
P.21	10th Avenue S / 9th Street S	143	0	2	40	1.80	1.66	2.98
P.22	13th Avenue S / 9th Street S	4	0	0	1	0.28	1.50	0.42
P.23	10th Avenue S / 14th Street S	65	0	0	13	0.89	1.40	1.25
P.24	10th Avenue S / 15th Street S	106	0	0	22	1.41	1.42	2.00
P.25	10th Avenue S / 25th Street S	73	0	0	23	1.09	1.63	1.77
P.26	11th Avenue S / 26th Street S	20	0	0	3	0.95	1.30	1.24
P.27	13th Avenue S / 26th Street S	3	0	0	0	0.21	1.00	0.21
P.28	15th Avenue S / 26th Street S	13	0	0	4	0.93	1.62	1.50
P.29	10th Avenue S / 29th Street S	25	0	0	5	0.47	1.40	0.66
P.30	10th Avenue S / 32nd Street S	56	0	0	15	1.06	1.54	1.63
P.31	32nd Street S / 11th Avenue S	2	0	0	0	0.20	1.00	0.20
P.32	10th Avenue S / 38th Street S	25	0	0	11	0.53	1.88	1.00
P.33	38th Street / Central Avenue	13	0	0	4	0.67	1.62	1.07

4.2. Safety Data Trend Analysis

In 2006, MDT developed its first *Comprehensive Highway Safety Plan* which involves a data driven approach to identifying areas where safety of the highway system can be improved. Then, in 2014, MDT announced the "Vision Zero" campaign, an initiative aimed at eliminating deaths and injuries on Montana's highways. The current update of the Highway Safety Plan, 2015, incorporates Vision Zero and identifies three emphasis areas, or factors which have the greatest contribution to severe accidents; Roadway Departure and Intersection Crashes; Impaired Driving Crashes; and Occupant Protection.

For the LRTP, it is important to identify safety trends and analyze how the City of Great Falls compares to both the Cascade County and the State of Montana. This analysis can show where the City's crash trends are similar or different than statewide trends, which can help identify areas for improvement in roadway safety.

For the analysis, the MDT Highway Traffic Safety Section supplied statewide crash statistics for January 1st, 2012 to December 31st, 2016. A safety data trend analysis was conducted to compare the crash characteristics of the City of Great Falls (only crashes within city limits), Cascade County, and the State of Montana.

4.2.1. Crash Severity

The emphasis areas were identified based upon a data analysis which compared crash severity with the cause of the crash. Those crash types that caused the most severe crashes were selected as the emphasis areas. Detailed crash statistics for the emphasis areas are provided in the following sections.

Comparison of crash severity statistics revealed that fatal and serious injury crashes accounted for a lower percentage of crashes within Great Falls as compared to both Cascade County and the State of Montana. Less than 1.0 percent of crashes resulted in a fatality for Belgrade, Gallatin County, and the State of Montana. **Table 7** tabulates the number and percentage of fatal and incapacitating injury crashes that occurred within Great Falls, Cascade County, and the State of Montana.

Table 7: Crash Severity Statistics

Location	Total Crashes	Fatal Crashes		Serious Injury Crashes	
City of Great Falls	7,979	6	*0.1%*	57	*0.7%*
Cascade County	10,211	50	*0.5%*	155	*1.5%*
State of Montana	106,268	947	*0.9%*	3,956	*3.7%*

4.2.2. Roadway Departure and Intersection Crashes

Roadway departure crashes occur when a vehicle leaves the travel lane, either crossing into an opposing lane, or leaving the roadway. These crashes often occur at high speeds and are therefore likely to be severe. The crash may include impact with an object on the side of the road or overturning. Intersections are the locations where the highest potential for conflict occurs, as vehicles, bicycles, and pedestrians often cross paths. These crashes may occur at highway interchanges, signalized or stop-controlled intersections, or intersections without traffic control. Mitigation strategies include problem identification, education, and enforcement of proper road use behaviors.

Great Falls has a much lower reported roadway departure crash rate than both the County and State with 9.4 percent of crashes being roadway departure crashes, as compared to 17.0 percent and 28.8 percent, respectively. Roadway departure crashes are typically less likely in urban areas due to lower travel speeds and the presence of curbing on the roadside.

Crash records show that Great Falls has a higher reported percentage of intersection crashes as compared to both the County and the State at 43.8 and 32.4 percent, respectively. These statistics indicate that focus should be directed to intersection safety in Great Falls. **Table 8** tabulates the total reported crashes and the percentage of crashes involving roadway departure or occurring at an intersection.

Table 8: Crash Type Statistics

Location	Total Crashes	Roadway Departure Crashes		Intersection Crashes	
City of Great Falls	7,979	754	*9.4%*	4,200	*52.6%*
Cascade County	10,211	1,740	*17.0%*	4,476	*43.8%*
State of Montana	106,268	30,587	*28.8%*	34,398	*32.4%*

4.2.3. Impaired Driving Crashes

Impaired driving is defined as operating a vehicle while under the influence of drugs or alcohol. There has generally been a greater focus on alcohol impairment, however, attention paid to drug impairment is increasing as awareness of impacts and methods for detection improve. Mitigation strategies include improved processes and regulations, enforcement, and prevention education.

Of the reported crashes, both Great Falls and Cascade County had a lower rate of alcohol/drug related crashes (6.4 and 7.5 percent, respectively) as compared to the State of Montana (10.0 percent). **Table 9** tabulates the total reported crashes and the percentage of crashes involving an impaired driver.

Table 9: Crash Statistics for Alcohol/Drug Related Crashes

Location	Total Crashes	Impaired Driver Involved	
City of Great Falls	7,979	510	*6.4%*
Cascade County	10,211	765	*7.5%*
State of Montana	106,268	10,643	*10.0%*

4.2.4. Occupant Protection

Occupant protection refers to the use of a safety belt or child protection seat by vehicle occupants. Seat belts offer the best chance for surviving or reducing the severity of injury in a crash. Overall, more than a quarter of people do not consistently use a seat belt in Montana. Improvement in seat belt use is imperative to achieve a goal of zero fatalities and zero serious injuries. Mitigation strategies include support policies, education, training, programs and activities, enforcement, and evaluation of the effectiveness of already implemented strategies.

Safety belt use data were reported on a per individual basis. As such, individuals involved in some crashes did not have the option to use a safety belt, for example motorcycles, pedestrians, or bicyclists. The data were adjusted to account for these users. Safety belt usage is approximately 95 percent in each City, County, and State. **Table 10** gives statistics for safety belt use.

Table 10: Crash Statistics for Safety Belt Use

Location	Number of Individuals	Using Restraints		Not Using Restraints	
City of Great Falls	18,780	17,747	*94.5%*	1,033	*5.5%*
Cascade County	22,935	21,715	*94.7%*	1,220	*5.3%*
State of Montana	226,127	213,597	*94.5%*	12,530	*5.5%*

4.2.5. Vehicle Type

Another area of concern, although not a defined emphasis area, is the type of vehicle involved in the crash. Although they generally occur less often, crashes involving either a motorcycle or a large vehicle can be very severe. As such, consideration should be given to these types of crashes.

Motorcycles were involved in less than 2 percent of all crashes in each the City, County and State with only 0.2 percent of crashes in the County involving a motorcycle. Large vehicles, i.e. semi-trucks, were involved in 3.6 percent of crashes within the City, less than both the County and the State with 4.7 and 6.1 percent, respectively. **Table 11** presents crash statistics based on vehicle type.

Table 11: Crash Severity Statistics

Location	Total Crashes	Crashes Involving a Motorcycle		Crashes Involving a Large Vehicle	
City of Great Falls	7,979	92	*1.2%*	287	*3.6%*
Cascade County	10,211	159	*0.2%*	479	*4.7%*
State of Montana	106,268	2,054	*1.9%*	6,524	*6.1%*

5.0 AREAS OF CONCERN

This section provides a list and description of areas of concern within the study area which should be taken into consideration as recommendations are developed for the LRTP. These areas were identified through review of existing traffic data, travel demand model projections, field review, public comment, and other resources. More discussion has already been provided in the previous sections and is reiterated here as appropriate.

5.1. Existing Transportation Conditions

The following roadways are currently either approaching or exceeding capacity (VOC ≥ 0.85):

- **9th St S** – 10th Ave S to Central Ave
- **River Dr N** – 15th St N to 25th St N

The following intersections experience a LOS of D or worse under existing conditions:

- 10th Avenue S / Fox Farm Road
- I-15 SB Ramps / Central Avenue W
- I-15 NB Ramps / Central Avenue W
- Vaughn Road / Central Avenue W
- I-15 SB Off Ramp / Airport Drive
- I-15 NB Ramps / Airport Drive
- River Drive N / 15th Street N
- River Drive N / 25th Street N
- Bootlegger Trail / U.S. 87
- 25th Avenue NE / 8th Street NE
- Smelter Avenue / 10th Street NE
- 6th Street SW / 4th Avenue SW
- Central Avenue W / 3rd Street NW
- River Drive N / 1st Avenue N
- Park Drive N / 2nd Avenue N
- River Drive S / 3rd Avenue S

- Fox Farm Road / 18th Avenue SW
- Fox Farm Road / Park Garden Road
- 13th Avenue S / 9th Street S
- 10th Avenue S / 29th Street S

5.2. Projected Transportation Conditions

The following roadways are projected to either approach or exceed capacity (VOC ≥ 0.85):

- **9th St N** – Central Ave to River Dr N
- **River Dr N** – 15th St N to 38th St N

The following intersections are projected to experience a LOS of D or worse by the year 2038:

- 10th Avenue S / Fox Farm Road
- I-15 SB Ramps / Central Avenue W
- I-15 NB Ramps / Central Avenue W
- Vaughn Road / Central Avenue W
- I-15 SB Off Ramp / Airport Drive
- I-15 NB Ramps / Airport Drive
- Tri Hill Frontage Rd / Airport Drive
- River Drive N / 15th Street N
- River Drive N / 25th Street N
- 36th Avenue NE / Bootlegger Trail
- Bootlegger Trail / U.S. 87
- Old Havre Highway / 15th Street N
- 25th Avenue NE / 8th Street NE
- Smelter Avenue / 10th Street NE
- River Drive N / 9th Street N
- NW Bypass / 3rd Street NW
- 6th Street SW / 4th Avenue SW
- Central Avenue W / 3rd Street NW
- River Drive N / 1st Avenue N
- Park Drive N / 2nd Avenue N
- River Drive S / 3rd Avenue S
- 2nd Street S / 3rd Avenue S
- Fox Farm Road / 18th Avenue SW
- Fox Farm Road / Park Garden Road
- 10th Avenue S / 2nd Street S
- 13th Avenue S / 9th Street S
- 11th Avenue S / 26th Street S
- 13th Avenue S / 26th Street S
- 15th Avenue S / 26th Street S
- 10th Avenue S / 29th Street S
- 10th Avenue S / 32nd Street S

5.3. SAFETY

There were 8,558 reported crashes within the study area between January 1st, 2012 and December 31st, 2016. Spikes in the number of crashes occur during peak hours on weekdays. Almost 50 percent of reported crashes occurred between 12:00 PM and 6:00 PM; over 78 percent of crashes occur on a weekday. In addition, over 50 percent of crashes occurred in an intersection or were related to an intersection. Rear-end and right-angle crashes accounted for almost 55 percent of crashes. A total of 82 incapacitating injury crashes and 17 fatal crashes occurred during the analysis time period.

The following are the intersections with the highest number of crashes per million entering vehicles:

1. 10th Avenue S / 9th Street S 1.80
2. Park Drive N / 2nd Avenue N 1.42
3. 10th Avenue S / 15th Street S 1.41
4. 10th Avenue S / Fox Farm Road 1.36
5. River Drive N / 1st Avenue N 1.17
6. 10th Avenue S / 25th Street S 1.09
7. 10th Avenue S / 32nd Street S 1.06
8. I-15 SB / Vaughn Road 1.04
9. River Drive N / 9th Street N 1.03
10. 11th Avenue S / 26th Street S 0.95

The following are the intersections with the highest severity index:

1. I-15 SB Ramps / Central Avenue W 3.00
2. I-15 SB Off Ramp / Airport Drive 2.38
3. Old Havre Highway / 15th Street N 2.09
4. Park Drive N / 1st Avenue N 2.05
5. Bootlegger Trail / U.S. 87 2.00
6. I-15 SB On Ramp / Airport Drive 2.00
7. 10th Avenue S / 38th Street S 1.88
8. 10th Avenue S / 20th Street S 1.83
9. 2nd Avenue N / 57th Street N 1.81
10. Tri Hill Frontage Rd / Airport Drive 1.80

The following are the intersections with the highest severity rate:

1. 10th Avenue S / 9th Street S 2.98
2. 10th Avenue S / 15th Street S 2.00
3. 10th Avenue S / Fox Farm Road 1.98
4. Park Drive N / 2nd Avenue N 1.82
5. 10th Avenue S / 25th Street S 1.77
6. River Drive N / 9th Street N 1.68
7. 10th Avenue S / 32nd Street S 1.63
8. River Drive N / 1st Avenue N 1.54
9. Central Avenue W / 3rd Street NW 1.51
10. 10th Avenue S / 20th Street S 1.51

Appendix A

Non-Motorized Technical Memo

Technical Memo # 1:

Great Falls Area Long Range Transportation Plan - 2014

Non-Motorized Existing Conditions

Submitted To:

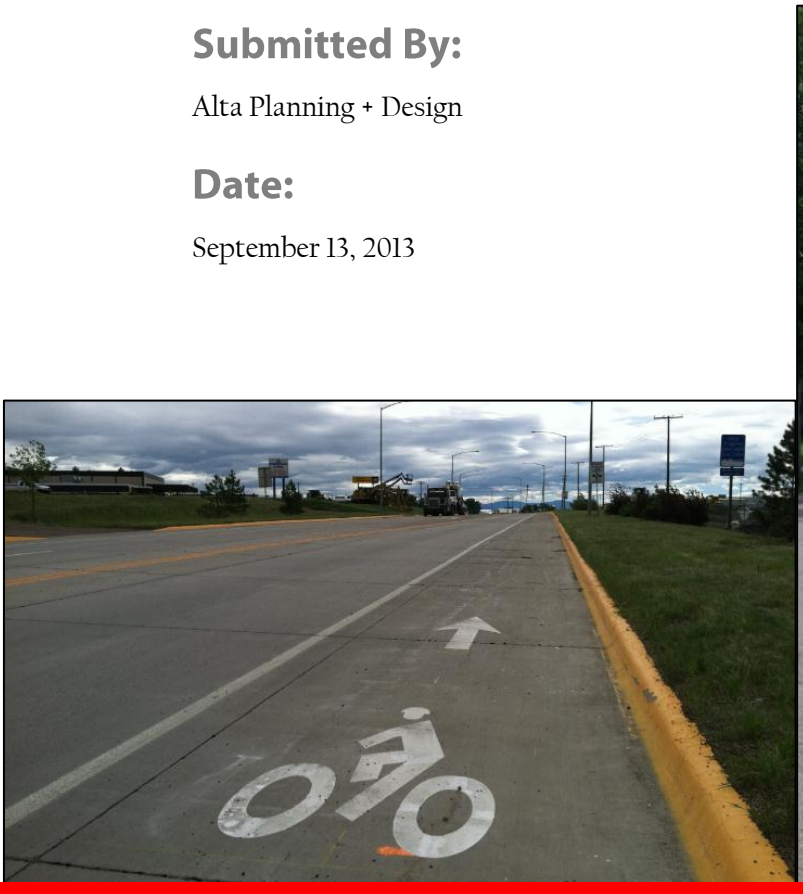
Great Falls TAC

Submitted By:

Alta Planning + Design

Date:

September 13, 2013





alta
PLANNING + DESIGN

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1 Demographics

1.1 Area Overview

The Great Falls Area (177 sq mi) includes the City of Great Falls, Montana (23 sq mi), Malmstrom Air Force Base, and other unincorporated areas that also comprise the major population center of Cascade County and the Great Falls, Montana Metropolitan Statistical Area. Most demographic information included in this chapter pertains to the City of Great Falls; data pertaining to other, surrounding communities' demographic information is specified.

The total population of Great Falls was 58,505 (6 percent of Montanans) as of the 2010 decennial census and an estimated 58,950 as of July 2011. The remaining communities in the Great Falls area (Belt, Cascade, Neihart, Black Eagle, Fort Shaw, Malmstrom Air Force Base, Simms, Sun Prairie, Sun River, Ulm, and Vaughn) and other portions of nearby unincorporated Cascade County areas have a combined population of 9,493, bringing the population for the Great Falls area to approximately 67,998 according to the 2010 Census. The population has increased over time and dramatically so during the post-war economic boom, with the only period of population decline being the 1970s and 80s. The cause of this decline could be attributed to the decline in production and the eventual closure of the Black Eagle Industrial Site in 1980. This site and associated industries were a significant job creator for the community.

1.2 Demographics

Race and Ethnicity

90 percent of residents of the City of Great Falls are European American, or White, and 2.2 percent of the population is foreign born[1]. This compares with 89.1 percent and 1.9 percent, respectively, at the statewide level.

Income

The median household income for Great Falls is $42,540, with 15.8 percent of Great Falls residents living below the poverty level. Compared to Montana statewide figures ($45,324 and 9.7 percent, respectively), Great Falls residents, on average, make slightly less annually and have more people living in poverty[2].

Military

In the City of Great Falls, there are 7,292 veterans (or 12.4 percent of the total population), with about 2,300, or 4 percent, of the total working population in the City currently employed in the Armed Forces. There are, in addition to this figure, 3,472 total residents on Malmstrom Air Force Base that are not

[1] *American Community Survey (ACS), 2007-2011, 5-Year Estimates.*

[2] *Ibid.*

included in the municipal Census or ACS data (but are included in the population figure cited above for the Great Falls area and surrounding communities). Of those who live on the base, 2,048 are Armed Forces Personnel. In summary, there are an estimated 4,400 Armed Forces personnel in the Great Falls Area, nearly half of which live on base.

The population of Malmstrom AFB consists mostly of families with young children. The two population ranges that include the highest number of people are "20-24 years old" and "Under 5 years old"[3].

Age & Education

The median age of the Great Falls area is 39 years old, with 19.9 percent of the total population under the age of 16 (too young to drive) and 8.4 percent over 75 years old (and typically less likely to or cannot drive). This means that roughly 30 percent of Great Falls area residents cannot drive or are less likely to drive. Increasing opportunities for and improving non-motorized infrastructure in the Great Falls area will not only benefit those who choose not to drive, but also those who cannot.

90 percent of residents over 25 years old in the Great Falls area have a high school degree or higher (including some college, an associate or bachelor degree, and/or a graduate or professional degree). This figure is 91.5 percent for the entire state of Montana.

Commute and Trip Choice

The vehicle or type of transportation that people choose for their trips, either commuting to and from work, doing errands, or other trips, is available via the American Community Survey (ACS) and the National Household Travel Survey (NHTS). The former includes commute mode share data while the latter includes mode share choices for all trips, regardless of purpose.

[3] *American Community Survey (ACS), 2007-2011, 5-Year Estimates.*

Commuting (ACS)

Bicycling

Five year ACS averages show that approximately 0.8 percent of commuters choose to travel to and from work by bicycle in Great Falls, this is an increase from 0.5 percent when measured during the 2000 Census. When compared to the rest of the United States, this figure is higher than the average, 0.5 percent, but is less than Montana's average mode share for bicycling to work, which is 1.3 percent. In comparison to other major cities in Montana, Great Falls has fewer bike-to-work commuters than Missoula, Bozeman, Kalispell, and Helena, but outperforms Billings and Butte. See Figure 1.

Walking

About 2.7 percent of commuters in Great Falls walk to and from work. This is lower than the national (2.8 percent) and state (5.1 percent) averages, and a decrease from the 2000 Census when 3.1 percent of commuters walked. Of the six other major cities used in the previous comparison, Great Falls has the lowest walking mode share. See Figure 1.

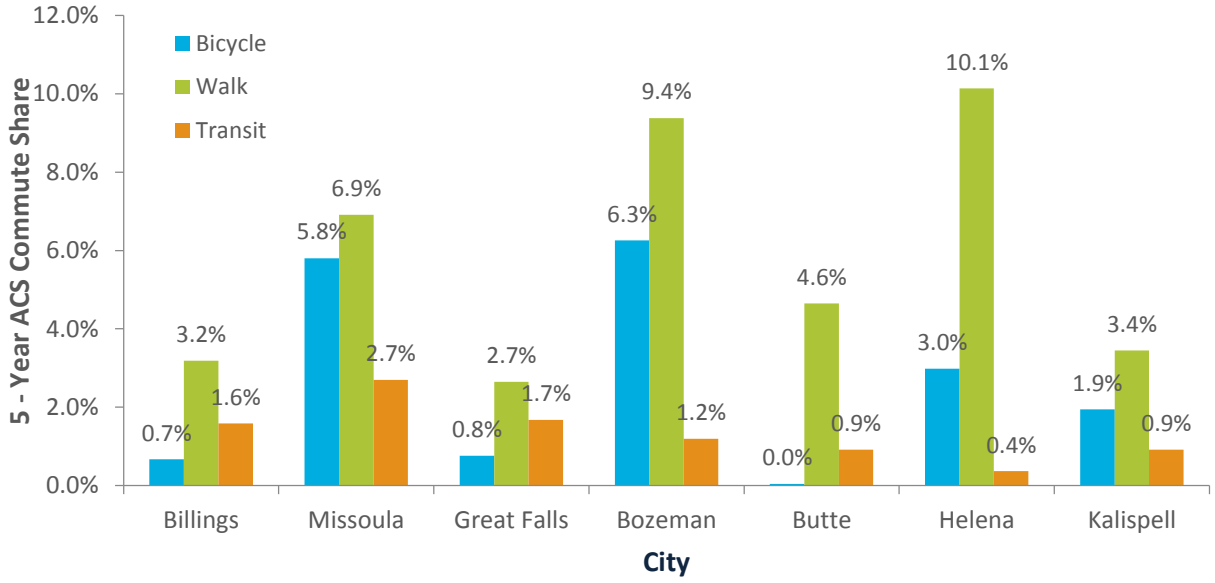


Figure 1: 5 Year ACS Commute Share of Seven Largest Montana Cities

All Trips (NHTS)

Trip mode share from the National Household Travel Survey is data that has been normalized using national averages from NHTS that provide non-motorized averages for percentage of all trips, not just commute trips. See Figure 2 for graph.

Bicycling

Bicycle mode share for all trips in Great Falls is estimated at 1.4 percent, which is higher than the national average (1.0 percent) but lower than the statewide average for Montana (2.5 percent). In comparison to other Montana cities, Great Falls' total bicycle mode share is higher than Billings and Butte, but lower than the other four larger cities highlighted.

Walking

An estimated 5.5 percent of all trips in Great Falls are walking trips, which is much higher than the ACS data outlining walking to and from work (2.7 percent), but it still remains lower than all six Montana cities in the graph and also lower than the national (6.1 percent) and Montana (10.6 percent) averages.

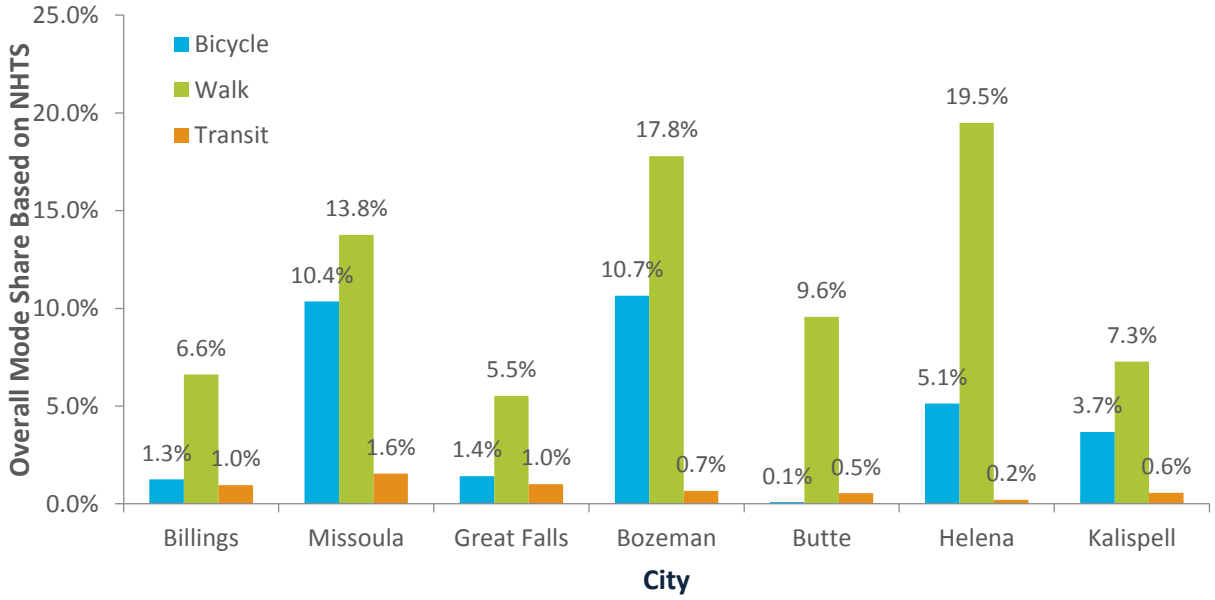


Figure 2: Overall Mode Share Based on ACS and NHTS of Seven Largest Montana Cities

2 Existing Plans, Codes, and Policies

2.1 Plans and Surveys

City of Great Falls Downtown Access, Circulation, and Streetscape Plan (April 2013)

A design document intended to supplement recommendations, vision, and plans made in the Great Falls Downtown Master Plan (2011).

This plan provides several options for recommended bicycle and pedestrian improvements on 1st Ave S, 2nd Ave S, 5th St, and 6th St – all currently one way streets. Improvements such as better sidewalks, street trees, bike lanes, shared lane markings, and two-way cycle tracks are included. The final recommendation for bicycle facilities on all four of the streets (which are currently one-way couplets) will have lane configurations consisting of two one-way travel lanes, parallel parking on both sides, and a one-way buffered bike lane (three foot buffer on the travel lane side and two foot buffer on the parking lane side) in the remaining space of the 50 ft of each street. The extents are below:

- 1st Ave S: 10th St S to Park Drive
- 2nd Ave S: Park Drive to 6th St S
- 5th St: 2nd Ave N to 6th Ave S
- 6th St: 5th Ave S to 2nd Ave N

Great Falls Area 2009 Transportation Plan

The last comprehensive update was adopted in 2003 with a minor update in 2009. The Great Falls Metropolitan Area must, at a minimum, update the Transportation Plan and perform a conformity determination no less frequently than every four years (ref. 40 CFR 93.104(b)(3)).

The vision of the plan and the community is that "our community should grow in compact patterns that facilitate pedestrian, bicycle, and transit travel. Walking should be a practical, safe, and enjoyable means of travel throughout all neighborhoods and shopping areas. Bicycling should become a more viable transportation choice for all residents and visitors in Great Falls" (p. 1-3).

The plan suggests that policies should be enacted in order to require 1) infill development where the land use pattern should be self-contained and promote compact, pedestrian-oriented development, and, 2) protecting and enhancing the area's air quality by reducing vehicle miles traveled and trips generated by using transit and non-motorized transportation modes (bicycling and walking) (p.1-7).

According to this document, when reviewing and updating the Bikeway Facilities Plan, planners/consultants should address the following issues:

- Balance the plan with a variety of facilities to meet the needs of cyclists with different skill levels.
- Link parks, schools, and other activity centers.
- Link the River's Edge Trail to the area-wide bike route system wherever possible.

- Study the expansion of the existing trail system to connect to Wadsworth Park along the Sun River and flood control levees.
- Explore opportunities for unpaved multi-use trails for mountain bikes and hikers.
- Develop policies and procedures for obtaining easements or rights-of-way for non- motorized transportation corridors throughout the community.
- Coordinate the Bikeway Facilities Plan with recommendations in the *Park and Recreation Master Plan (1995)*. In some areas, the seven new trails recommended in the Master Plan duplicate routes in the proposed Bikeway Facilities Plan (p. 1-11)

In Chapter 1, pilot traffic-calming projects including bulbouts, a City-County Bicycle and Pedestrian Advisory Committee, increased trail and path construction, and review of design standards for roadways are suggested (p. 1-10 – 1-14).

Chapter 2 addresses bicycle and pedestrian traffic on the River's Edge Trail, in the Central Business District, as well as ADA wheelchair access ramps, and sidewalk locations on major streets. Maps providing where there exist sidewalk gaps, ADA wheelchair access ramps, lighted corridors, and existing trail system are also included in this chapter. The figures and maps in this chapter should be used as a starting point for prioritizing corridors for upgrades. Each individual block face and intersection should be separately evaluated for sufficiency of pedestrian and bicycle facilities, according to the Plan. ADA facilities in outlying areas are lacking, as well as sidewalks and other non-motorized transportation mode facilities.

The maps included in Chapter 5, which are completely dedicated to pedestrian and bicycle planning, differ significantly from the Existing/Proposed Trails Network map (Figure 2-18) included in Chapter 2 (Existing Conditions). Maps in Chapter 5 are somewhat confusing in that they lump all existing facilities regardless of type together in one line type and show proposed bike lanes, bike routes, and some trails as by individual facility type. Additionally new recommendations as proposed in the 2009 plan are all one color regardless of the recommended facility type. Committed and proposed bikeway network and system improvements are outlined and include extent, cost, and proposed location. The total cost for the bikeway network and system projects is estimated by this plan at $3,462,900.

Chapter 7 includes further discussion of and suggestion for traffic calming in order to benefit pedestrians, especially around schools (p. 7-29). In Chapter 12, suggested street alignments, traffic calming, and ROW requirements are outlined. Most of the suggested cross sections include at least one option depicting facilities for pedestrians and bicyclist. These facilities typically include improved sidewalks and vegetated buffers, bike lanes, and shared use paths. Chapter 14 includes possible funding sources for bicycle and pedestrian projects, such as CMAQ and MACI (which have been used previously), and TIF.

Downtown Great Falls 2013 Safety Plan

This plan makes relatively no mention of bicycling or walking. Chapter 2: Safety Plan Framework references the Downtown Master Plan in identifying one safety related goal/strategy, which is, to "improve pedestrian connectivity and safety Downtown and develop public/private partnerships to ensure Downtown is safe for all users" (p. 5).Chapter 6: Downtown Public Safety Resource & Referral List makes a quick mention of the link to report non-emergency crimes, which include bike thefts (http://www.greatfallsmt.net/police/report-crime-online).

City of Great Falls 2011 Downtown Master Plan

"The Downtown Master Plan provides a strategically focused, goal driven "blueprint" for the future growth and development of Downtown. The plan includes 82 strategies that each serve to make Downtown Great Falls a more desirable place to live, conduct business, recreate and visit."

This plan identifies several objectives that apply to bicycling and walking, both individually and when the two modes overlap. The following objectives and chapter sections apply to bicycling and walking and include visual and some semi-technical elements to consider in the redesign of streets and surrounding areas and corridors in order to increase viability and safety of bicycling and walking. In Chapter 3, under Goal 1: Connected Downtown:

- Objective 1 (improve pedestrian connectivity and safety)
- Objective 2 (develop a comprehensive Downtown bicycle network to connect into a city-wide system)
- Objective 4 (improve connectivity to the Missouri River, River's Edge Trail, and Gibson Park for bicycles and pedestrians)
- Exhibit I: A Closer Look at Complete Streets
- Exhibit J: A Closer Look at One-way Conversion
- Objective 6: Optimize Downtown parking for all stakeholders (bicycle parking)

Figure 8: Implementation Table (Chapter 3) describes the intention of capital improvement projects and how basic upgrades of public infrastructure are great gateways to accomplishing projects related to bicycling and walking. Chapter 3's Strategy 1: Connected, defines the objectives included above by individual, implementable projects including funding sources, project timeline range, and what type of project it is (capital improvement, program, regulation, etc.).

An online survey was included in the creation of this plan and nearly 450 respondents contributed to better understand demographics and preferences downtown (p. 69-72).

- 52 percent of respondents use downtown daily
- 56 percent come for the shopping, 52 percent work downtown, 42 percent enjoy dining in downtown, and 37 percent use other services provided by downtown businesses
- 94 percent use a car to get to downtown, 4 percent walk, 2 percent ride a bicycle, and none took the bus
- 47 percent of respondents believe that downtown is safe; 56 percent agree that it is clean
- Very few people, however believe that downtown is a desirable place to raise a family (only 10 percent)
- A cleaner and safer environment, with better landscaping and more green space, would be appealing to some (23 percent) respondents.
- Parking issues (9 percent) were identified by some respondents as detriments to downtown living

Conclusions from the One-way Street Conversion Survey

This report is an important document to consider in light of bicycle and pedestrian planning because it shows public sentiment regarding traffic lane realignment and significant changes to existing

infrastructure. The Great Falls Business Improvement District (BID) asked the City to consider a proposal to convert two downtown, one-way couplets back to two-way streets. The couplets and segments in question are 5th and 6th Streets between 8th Avenue North and 10th Avenue South, and 1st and 2nd Avenues South between Park Drive and 15th Street.

The project sought public comment and, overall, most respondents were in favor of keeping the streets one-way, in couplets, and improving them with trees and improved storefronts. The majority of customers and home and business owners on ALL streets highlighted in this survey analysis and conclusion said that one-way streets helped, instead of hindered, customers getting to businesses downtown. They also said that smooth traffic flow was more important than slower traffic. 53 percent said they would not support any changes to the streets identified in the survey.

One respondent who owns properties on 5th St and 6th St S, where 3 lanes merge to 2 lanes, had a different opinion. He/she reports fast automobile traffic and almost no one stopping for foot traffic, even school children unloading from the bus, even though there is a pedestrian crossing on the corner.

This report is significant as it depicts observed public resistance (from at least some of the population) to traffic lane realignment and significant changes to existing infrastructure.

2.2 Code

City of Great Falls Municipal Code

The municipal code includes legality of certain actions and includes definitions of and ordinances and laws pertaining to bicycling and walking in Great Falls.

The code sets several definitions including defining a bicycle as a type of vehicle (10.3.010 – Definitions), and that bicyclists as operators of vehicles shall obey the instruction of any official traffic-control device" (10.21.020 – Obedience required).

The code further states that it is illegal to bicycle on the sidewalk within the CBD east of the west side of Park Drive. Bicycles operated by the Police Department are exempt from the CBD sidewalk law. Additionally, any person bicycling on the sidewalk in the rest of the City, where it is legal, must yield the ROW to any pedestrian and give audible signals before passing them (10.72.010). In 12.32.020, this code is contradicted because it states that it is illegal for horses, mules, animals, buggy, wagon, bicycle or other vehicle to be ridden or driven on any sidewalk in the City.

Property owners are responsible for the maintenance of sidewalks in front of and adjoining their property. They are responsible also for reconstruction of buckled or dangerous sidewalks caused by natural deterioration (12.28.130).

Developers may propose and the City may require traffic calming to provide safety and encourage walking as transportation and will be determined on a case-by-case basis (17.32.130).

All new streets must meet the City's growth policy, as outlined in the 2009 Great Falls Area Transportation Plan. Sidewalks must also be provided on both sides of public and private streets. In residential areas, a boulevard area (vegetated, usually) shall be included and must be at least six feet wide. Sidewalks must also be ADA compliant (17.32.080).

There is no bicycle parking requirement in Great Falls. However, when bicycle parking is provided, it may substitute for a vehicular parking space up to a maximum of 5 percent of the required number of parking space, or 10 spaces, whichever is less (17.36.3.010). Exhibit 36-6 in the Municipal Code gives recommended number of bicycle parking spaces at different types of buildings. The code does get stricter on where the bicycle parking spaces are located. They cannot be more than 100 feet from the entrance and should be as close as or closer than the nearest automobile parking space. Parking must be distributed to serve all buildings or entrances when there are more than one, must have adequate lighting, must hold the frame and not just the wheel, must be able to be used with a U-lock, must accommodate a variety of bicycle types, must be securely fastened to the ground, and must be accessible without moving another bicycle.

Cascade County Zoning Regulations (2012):

A recreational trail is defined by Cascade County as a "linear path which may be dedicated to a single use or multiple uses". The zoning regulations definitions section then states that hiking trails, bike trails, cross-country ski trails, and horse trails are all examples of a recreation trail. The document does not, however, list bicycles as a recreation vehicle, reserving this definition for camping trailers, motor homes, and the like. Pedestrian walkways are listed as cross-routes that should affect the planning of landscaping plans.

Cascade County Subdivision Regulations (2007):

In the section on "Blocks", the regulations document states that "rights-of-way for adequate and safe pedestrian access, at least 10 feet wide, must be provided where deemed essential to provide circulation to schools, playgrounds, shopping, transportation, and other community facilities". In Section VI-H, subsection b titled "Improvements", it states that subdivision street improvements including "pavement, curbs, gutters, sidewalks, and drainage must be constructed in accordance with the specifications prescribed" in the document using materials approved by the Cascade County Commissioners. Specifications are provided after in the form of sample designs and materials lists and procedures. Furthermore, any proposed road plan and profile must include the type and location of sidewalks and curbs. There is no mention of or reference to bicycling, bicycle infrastructure, or bicyclists as users in the whole of the document.

Table 1: Great Falls Municipal Code 17.36.3.010 - Bicycle parking

Land use	Number of recommended spaces
Multi-family housing	1 space per 2 apartments
Primary or secondary school	10 percent of the number of students, plus 3 percent of the number of employees
College or university	6 percent of the number of students, plus 3 percent of the number of employees
Dorms, fraternities, sororities	1 spaces per 3 students
Shopping mall	5 percent of the number of vehicle parking spaces
Office	5 percent of the number of vehicle parking spaces
Governmental	10 percent of the number of vehicle parking spaces
Movie theater	5 percent of the number of vehicle parking spaces
Restaurant	5 percent of the number of vehicle parking spaces
Manufacturing/industrial	3 percent of the number of vehicle parking spaces
Other	5 percent to 10 percent of the number of vehicle parking spaces

From field observations in Great Falls it appears that few businesses have provided bicycle parking.

2.3 Policies

Great Falls Growth Policy – Transportation Element

The current Growth Policy (GP) for Great Falls has not been fully updated since 1999, receiving minor updates in 2003 and 2005. On December 20, 2011, Great Falls City Commission passed Resolution 9951 directing the Planning Advisory Board to begin the process of formally updating the City's GP. The GP is an official public document that is intended to guide future social, physical, environmental, and economic growth and development of the City. The updated GP will be adopted and used by the City of Great Falls to guide policies and decisions regarding future growth and development. The transportation element, specifically bicycling and walking, of the GP will be considered here.

The Pedestrian and Bicycle Circulation element of the GP assumes that most people in Great Falls will continue to use motor vehicles as their main mode of transportation (p. 18). The benefits of bicycling are

not only physical for the user, but if "enough people can be diverted from driving to bicycling or walking for some of their daily trips, motor vehicle traffic can potentially be reduced or expensive street improvements may be avoided or delayed." Residents also expressed a desire for more pedestrian and bicycling facilities in the area in 1999, which reflects their interest in having more choices in how to travel around the community. The expansion of the River's Edge Trail system is cited as another indicator that Great Falls residents desire more infrastructure, especially separated facilities.

Shared roadways (including shared lane markings) are "adequate on low-volume collectors or local streets where motor vehicles can safely pass bicyclists" (p. 20). Other standard roadway treatments like bike lanes, paved shoulders, and multi-use paths are also proposed.

Vision #4 in the "Transportation Vision" is to "facilitate pedestrian, bicycle, and transit travel. Walking should be a practical, safe, and enjoyable means of travel throughout all neighborhoods and shopping areas. Bicycling should become a more viable transportation choice for all residents and visits in Great Falls." Vision #6 is to "have streets, trails, and walkways that are planned, built, landscaped, and maintained as safe and attractive public spaces linking a balanced system of open lands, natural areas, recreation facilities, schools, and parks with trails and urban streetscapes" (p. 25-26). Goal #2 is to "make…non-motorized modes of transportation viable alternatives to the private automobile for travel in and around the community" (p. 26).

Policies or parts of policies in the GP that apply to bicycling and walking include:

- The land use pattern should promote pedestrian-oriented development, address transportation system needs, and enhance opportunities for walking and bicycling, while increasing connectivity and smooth flow of all transportation modes throughout the community
- New development on the urban fringes or in rural areas should give primary consideration to non-motorized circulation and to transit service
- Pedestrian bicycle access to natural features, historic and cultural resources, parks, schools, and other focal points should be improved. The emerging identities of new neighborhoods should include multiple transportation choices
- Air quality can be improved by using non-motorized transportation modes
- New streets should be in compliance with the Great Falls Area Transportation Plan
- Private enterprise should also be encouraged and supported to provide non-motorized transportation choices. On-street bicycle lanes or off-street pedestrian/bicycle paths should connect all neighborhoods
- The movement of traffic to, from, and within downtown should be a prime consideration in planning, designing, and building all roads as well as pedestrian and bicycle infrastructure.
- Pedestrian and bicycle facilities should be linked when planning transportation system improvements and when reviewing land development proposals. New public and private developments should accommodate the bicycle system by providing access to schools, parks, jobs, shopping centers, and transit facilities and should provide users with facilities for safe and direct crossings of Principal and Minor Arterials. Developers should be required to install paths that connect to the bikeway system recommended in the Bikeway Facilities Plan. In some cases, it may be appropriate to relax a requirement, such as for a sidewalk on one side of a residential street in favor of a comparable bicycle path in the development (p.26-30).

Further, strategies and actions regarding new standards and regulations that encourage pedestrian and bicycle-friendly development, traffic calming, bikeway facilities plan updates, a City-County BPAC, provide sufficient resources to construct trails and bikeways in Parks and Rec & the Bikeway Facilities Plans, access to Smelter Hill by bicycle and foot are all encouraged and framed at the end of the Policy. Most policies, goals, strategies, and plans within the Growth Policy relate in one way or another to non-motorized transportation choices. The universal incorporation of these modes in the GP is encouraging, but action is required to make the vision of the City and its residents a reality.

2.4 Programs

Great Falls Transportation Improvement Program FFY 2011-15

This document includes review of projects related to walking and bicycling that have been completed since 2006 and which are planned for implementation during the Federal Fiscal Years (FFY) of 2011 to 2015.

Table 2: Great Falls Area Transportation Improvement Program FFY 2011-15

Category	Project	FFY	Description	Funding Agency	Total cost	Status	Rank
Pedestrian only	Sidewalks - GTF	2006	Sidewalks on 3rd St NW/Smelter/NW Bypass	State/Federal	$910,000	Complete	n/a
Pedestrian only	City-wide sidewalks	2009	Sidewalks, various locations	State/Federal/ Local	$4,310,100	Complete	n/a
Bicycling and pedestrian	38th St/8th Ave N/6th St SW	2009	Trail/Bike/Ped Improvements	State/Federal/ Local	$634,700	Complete	n/a
Bicycling and pedestrian	Bay Drive Bike/Ped Path	2010	Bike/Ped path	Federal/Local	$936,000	Complete	n/a
				Total cost of bicycling and walking projects since 2006:	$5,220,100		

Category	Project	FFY	Description	Funding Agency	Total cost	Status	Rank
Pedestrian only	ADA/Curb Ramps Program I (**MDT**-1st AVE N-35th to 38th-$201,550; **MDT**-2nd Ave N 37th to 15th-$408,760; 9th St N-River Drive-$306,200) (**City**-25th St N, 26th St S, 8th Ave N, 38th St N, 6th St S & Park Drive)	2015	Install ramps at various locations	CMAQ	$2,047,389	Planned	1st
Bicycling and pedestrian	Sun River Trail Connection	2015	Bike/Ped facility adjoining Country Club Blvd (from Warden Bridge to Bike/Ped Facility at 6th St SW)	CMAQ	$2,061,080	Planned	3rd
Pedestrian only	Great Falls Sidewalk Infill Project	n/a	Sidewalks	CMAQ	$833,571	Planned	4th
Pedestrian only	2001 Sidewalk Program	2011	Construction, additional	MACI, FHWA/CMAQ	$114,076	Planned (2008)	n/a
Pedestrian only	Sidewalks-GTF 1st Ave N & 2nd Ave N	2011	Construction	Other Highway Funds	$1,360,000	Planned (2008)	n/a
Bicycling and pedestrian	2003 Bike/Ped Facility Improvements	2012	RW/IC/Construction-Release	MACI, FHWA/CMAQ	$91,809	Planned (2008)	n/a
Pedestrian only	Sidewalks-Fox Farms Park Garden	2012	Construction-Release	MACI, FHWA/CMAQ	$32,856	Planned (2008)	n/a
Pedestrian and disability	ADA/Curb Ramps Program	2013	PE	MACI, FHWA/CMAQ	$221,546	Planned (2008)	n/a
Pedestrian and disability	ADA/Curb Ramps Program (Local)	2014	RW/IC/Construction	MACI, FHWA/CMAQ	$1,824,141	Planned (2008)	n/a
Pedestrian only	Sidewalk Infill Project	2014	PE	MACI, FHWA/CMAQ	$168,000	Planned (2008)	n/a

Total cost of planned bicycling and walking projects: $8,754,468

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3 Bicycling

3.1 Types of Bikeways

Consistent with bikeway classifications throughout the nation, these Bikeway Design Guidelines identify the following bikeway classes by degree of separation from motor vehicle traffic.

Paved Shoulder Bikeway

This type of bicycle facility may be helpful for Cascade County. The AASHTO *Guide for the Development of Bicycle Facilities* includes this bikeway type especially for application in rural communities in which "adding of improving paved shoulders often can be the best way to accommodate bicyclists". The paved shoulder also has geometric benefits for motorists, as well, which are described below under 'Bike Lanes'.



Shoulder Bikeway

Shared Roadways

Bikeways where bicyclists and cars operate within the same travel lane, either side by side or in single file depending on roadway configuration. The most basic type of bikeway is a signed shared roadway. This facility is used to connect other bikeways (usually bike lanes), or designate preferred routes through high-demand corridors.



Shared Roadway

Bicycle Boulevards

Shared roadways may also be designated by pavement markings, signage, and other treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.



Bicycle Boulevard

Bike Lanes

This type of separated bikeways uses signage and striping to delineate the right-of-way assigned to bicyclists and motorists. Bike lanes encourage predictable movements by both bicyclists and motorists.



Bike Lane

Cycle Tracks

Bikeways that combine the user experience of a separate path with the on-street infrastructure of conventional bike lanes.



Cycle Track

Shared Use Paths

Bikeways in rights of way separate from roads, and are for the use of bicyclists, pedestrians, and other non-motorized users such as skateboarders and rollerbladers.



Shared Use Path

Why Separated On-Street Facilities

A national study comparing streets with bike lanes to those without found that 15 percent of bicyclists on streets without bike lanes rode on the sidewalks, versus 3 percent on the streets with bike lanes. In addition, on streets with bike lanes, 81 percent of bicyclists obeyed stop signs, versus 55 percent on streets without[4].

One's chance of injury drops by about 50 percent when riding on a major city street with a bike lane and no parked cars (as opposed to a major city street without bike lanes and with parking)[5].

Separated facilities also provide a buffer for pedestrians by creating more space between sidewalks and moving motor vehicle travel lanes. They also provided a breakdown lane for motorists and a clear recovery zone (for errant vehicles that leave the traveled way to recover into their own lane).

When Bozeman, Montana, installed a greater network of bike lanes, bicycle commuting mode share went from 4.7 percent of commute trips to 6.3 percent of commute trips between 2000 and 2010. Missoula's

[4] *"CDD." City of Cambridge, Massachusetts. Web. 5 Aug. 2013. <http://www.cambridgema.gov/cdd/transportation/design/bicycling/bicyclelanes.aspx>.*

[5] *Badger, Emily. "Dedicated Bike Lanes Can Cut Cycling Injuries in Half." The Atlantic Cities. Web. 5 Aug. 2013. <http://m.theatlanticcities.com/commute/2012/10/dedicated-bike-lanes-can-cut-cycling-injuries-half/3654/>.*

bicycle commuting mode share also increased to 5.8 percent for similar reasons. Bozeman measured an instantaneous increase in bicycling and walking along West Babcock Street in 2007 of 256 percent when bike lanes and sidewalks were installed.

3.2 Facilities and Programs

The Great Falls area is fortunate to boast an approximately 47 mile off-street bicycling and walking system along the banks of the Missouri River. The city's first bike lane was installed in Summer 2013. Two signed east-west bike routes exist north of downtown. This relative lack of designated on-street bicycle infrastructure is a veritable blank slate and represents a significant opportunity to plan and implement a network of bicycle facilities in the Great Falls area.

River's Edge Trail

Background

According to the River's Edge Trail (RET) website, this 47+ mile trail system "is the result of 20 years of cooperative partnership efforts by the City of Great Falls, Cascade County, Montana Department of Fish, Wildlife & Parks, Montana Department of Transportation, electric utility PPL Montana, a volunteer trail advocacy group Recreational Trails, Inc., and a supportive community. As a result of this work, the River's Edge Trail has grown into a treasured community asset. Since 1990, the trail has grown to more than 47 miles.



River's Edge Trail northwest of Downtown Great Falls

The RET system is composed of:

- 20.34 miles of paved paths and trails,
- 1.42 miles of a mix of paved and unpaved or natural trails, and,
- 25.32 miles of unpaved or natural trails (primarily used for singletrack mountain bike riding and walking/hiking).

The history of the River's Edge Trail began with a conceptual plan for a riverside recreational trail in Great Falls (as developed by the City-County Planning Board staff in 1989). Dubbed the *Riverfront Recreational Corridor*, the trail was to extend 7 miles from the Broadwater Bay area downstream to Rainbow Falls. The trail, re-named the *River's Edge Trail* following a Name-the-Trail contest in the Great Falls Tribune, captured the interest and support of the community. A volunteer group that advocated local bike trails, also in 1989, as part of the Vision 2000 community planning process, began working with the City to develop the first segments of the trail. That group was formalized as a non-profit 501 c3 corporation named *Recreational Trails, Inc. (RTI)*.

Over the last 20 years RTI has continued to work with the City, County, FWP, PPL Montana and many other partners, agencies, groups and individuals to extend and improve the 47+ mile trail. Much of the trail has been constructed on abandoned railroad and road rights-of-way and structures. Miles of new

trail connecting these segments have been constructed, as have many new tunnels, underpasses, bridges and trailheads. Volunteers have undertaken an on-going intensive cleanup of riverfront lands that had been littered with debris over the past decades, and have spent thousands of hours on weed control, tree planting, maintenance, and enhancement projects.[6]"

Popularity and Use

In March 2013, the Great Falls Tribune reported that the River's Edge Trail is the envy of other communities, local and otherwise, with five waterfalls and breathtaking views[7]. In the first public open house and in many meetings with stakeholders for this plan, which were held on June 19, 2013, the attractiveness of the trail was a big talking point. Many see it as a central spine of the active transportation system and something that additional infrastructure should tie into, wherever possible.

Signage

New signage on the River's Edge Trail, including wayfinding directions and distance to popular destinations and trail featured, was installed in summer 2013. Signage existing prior to this improvement featured standard paper maps of the trail system behind weatherproof glass (see photo). Trailhead markers with the River's Edge Trail logo and restrictions are also near many entrances/exits on the trail.



River's Edge Trail signage

57th Street N/2nd Avenue N Bike Lanes

The 57th Street N/2nd Avenue N bike lanes were installed in June and July 2013 between the 2nd Ave N gate of Malmstrom Air Force Base on the east, west to the intersection of 57th St N and 2nd Ave N, and then north and northwest till 38th St N & the River's Edge Trail extension. There is no parking along 57th St N for the entirety of the section with bike lanes. Bike lanes are against the curb. There are also minimal driveways, which may equate to fewer motorists crossing the path of bicyclists than on other residential streets or those with commercial density. The bike lanes were installed to connect the Air Force base population to the River's Edge Trail and to the community at large, among other benefits. Although 'Bike Lane' signs (R3-17, MUTCD) are optional, the City has requested that MDT install them along the route.



57th St N/2nd Ave N bike lanes, installed Summer 2013

[6] *"History of the Trail." The River's Edge Trail. Web. 5 Aug. 2013. <http://thetrail.org/history.html>.*

[7] *"Meandering trail is envy of other towns." Great Falls Tribune 24 Mar. 2013. Web. 5 Aug. 2013.*

Existing Bicycle Network

Great Falls Area Long Range Transportation Plan 2014

Legend

- Existing Bike Lane
- Proposed Bike Lane
- Bike Routes
- Multi-use and Park Paths
- Unpaved Path
- Local Road
- Secondary Arterial
- Primary Arterial
- State Route
- Urban Route
- Non-Interstate Highway
- Highway or Freeway Ramp
- Interstate Highway
- Great Falls City Boundary
- Study Area

alta PLANNING + DESIGN

0 0.25 0.5 1 Miles

Data obtained from City of Great Falls
Map created September 10, 2013

4th Avenue North Bike Route

The bike route on 4th Ave N is the newest of Great Falls' two signed shared roadways. It is an east-west route north of Downtown between River Dr on the west and 38th St N on the east.

This is a quiet neighborhood street (25 mph speed limit), close to homes and parks. Many of the intersections on 4th Ave N are uncontrolled (no stop signs or signals) and bicyclists must be vigilant at each intersection and check for cross traffic from perpendicular streets. There is also a problematic link with Gibson Park and the River's Edge Trail on the western terminus of the bike route. Crossing River Dr after the bike route ends require navigating another uncontrolled intersection of 4th Ave N and a much busier road. MDT was initially hesitant to this improvement because of the lack of receiving infrastructure on the opposite side of the road (e.g. sidewalks, paths, etc.). The signs along 4th Ave N indicating that it is a bike route are standard D11-1 signs (MUTCD).



Bicyclist riding on the 4th Ave N bike route



Children and supervisors crossing Park Dr (from 4th Ave N) without crosswalks or sidewalks (on the receiving end)

8th Avenue North Bike Route

8th Ave N is a two-way, two lane "urban route" or collector road. It is 45 ft wide with two 15 ft travel lanes and two 7.5 ft parking lanes. It slopes downhill toward the west and uphill toward the east. Similar to 4th Ave N, it provides connectivity between Park Drive on the west and 38th St N on the east. This road is busier than 4th Ave N, with between 3,000 and 5,000 vehicles each day (depending on the section of the street) but still a 25 mph speed limit (and 20 mph for trucks) and has the same bikeway classification. There is not great connectivity to the River's Edge Trail or to parks on its western terminus. It is one of the most northern continuous east-west streets on the south side of the Missouri River. The signs along 8th Ave N indicating that it is a bike route are standard D11-1 signs (MUTCD).

3.3 Bicycle Parking

The existing policies and programs regarding bicycle parking for the City of Great Falls and for Cascade County state that there is not a requirement to provide bicycle parking. The installation of bike racks is currently completely up to the developer or the business owner. There is, however, a credit for vehicle parking spaces if bike parking spaces are also provided (17.36.3.010). The location of proposed bicycle parking spaces is reviewed by City staff and the Design Review Board when development plans are submitted to the City.

In Downtown, permission was granted to the Business Improvement District (BID), and its chair Joan Redeen, to place bike racks on sidewalks in the public right of way (ROW). As new bicycle parking has been installed on downtown streets, it has been accepted and utilized by the community. There are, however, no long-term maintenance agreements between the City and the BID or the individual business owners regarding the future upkeep of the existing and any additional racks.



Bicycle parking at the Great Falls Public Library

If bike racks are installed independently and on private property, the City does not have any responsibility to maintain them. Their only role is to encourage it and support future growth of bicycle parking.

Although there are many racks at public places like the Great Falls Public Library and in some locations in the BID, there is not a City or area-wide ordinance, initiative, or program to ensure that bicyclists have a place to park their bicycles when arriving at destinations. Without the assurance or predictability of bicycle parking, bicycling use may not be reaching its potential.

3.4 Maintenance

River's Edge Trail

Maintenance of the River's Edge Trail is shared between the Great Falls Parks and Recreation Department, Recreational Trails, Inc., and contracted maintenance crews, with funding for maintenance provided by the former two. Great Falls' Parks and Recreation Department mows the two feet on either side of the trail (because of the trail's nature as a linear park facility), clears snow, cleans and empties toilets and trash cans, and arranges with Cascade County for weed abatement and spraying.

Budget

All other maintenance, including repaving and crack sealing, is completed with a $5,000 budget provided by the City and private funds from RTI, which contracts with private maintenance companies to complete repairs and maintenance. The funding provided is inadequate for annual trail needs and represents the capacity to repave less than 100 feet annually for the existing trail system. RTI would like to contribute monetarily to the City of Great Falls so that they can maintain the trail better and in its entirety.

A local engineering firm, TD&H, is currently developing a comprehensive maintenance plan for the River's Edge Trail with initial and maintenance costs for current trail and future expansion. The plan seeks to help the trail function well and retain its popularity and utility. It is expected to be completed in Fall 2013.

Examining trail maintenance budgets from other cities and counties in the United States will provide some insight into how to best utilize a limited budget and what costs are in areas with similar climate

conditions and trail infrastructure. Although there are many variables in maintenance and construction costs (crossings, concrete vs. asphalt vs. natural surfaces, climate, use, etc.), experience from other places may yield ideas and innovation in Great Falls.

Milwaukee County, Wisconsin

Milwaukee County maintains about 130 miles of paved and natural surface trails. The County spends $2,525 per mile to maintain existing asphalt paths and between $24.13 to $154.13 per mile for snow plowing, depending on the trail and surface type, width, and amount of snowfall. Trimming back vegetation and removing storm-damaged material for approximately 16 weeks out of the year costs $150,000. Landscaping on new trails and replacing landscaping on existing trails totals $110,000 while drainage installation, asphalt and washout repair for two weeks of the year costs $20,000.

Wisconsin Department of Natural Resources

On paths and trails within the WDNP's jurisdiction, approximately $2,000 per mile is spent on all maintenance costs combined according to their internal Trail Cost Model.

Iowa Department of Transportation.

IDOT builds and maintains trails and paths of a variety of surface types. Total annual maintenance costs are estimated at approximately $1,500 per mile.

Rails to Trails Conservancy

According to the Conservancy's Rail Trail Maintenance & Operation Manual, a minimum of $1,200 per mile for privately owned trails and approximately $2,077 per mile for government-maintained trails is spent on maintenance. This is applicable to Great Falls and the River's Edge Trail because parts of the RET are on former rail right of way[8].

Michigan Trails and Greenways Alliance

In 2007, the Michigan Trails and Greenways Alliance produced a document entitled "Statewide Greenways Maintenance Inventory and Case Studies", which outlines different maintenance costs on different trail type throughout the state[9].

On unpaved, low-maintenance natural trails with few if any trailheads, MTGA found that costs were much lower than for hard surface trails that run through cities, under roads, and with many trailheads and accesses. On the former type, MTGA estimated maintenance costs at around $221 to $500 per mile. Some snowmobile clubs, where they exist, near the natural surface trails split the costs of maintenance equipment 60/40 with the county and then buy the equipment in earnest over 5 years. They also provide most of the maintenance labor.

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[8] *"Maintenance." American Trails – National Resource for Trails and Greenways. Web. 5 Aug. 2013. ‹http://www.americantrails.org/resources/ManageMaintain/MilwMaintcost.html›,*

[9] *"Statewide Greenways Maintenance Inventory and Case Studies." Michigan Trails and Greenways Alliance. Web. 5 Aug. 2013. ‹http://www.michigantrails.org/blog/wp-content/uploads/statewide-trail-maintenance-survey-final.pdf›.*

Mid-level trails that require more maintenance than the aforementioned type cost between $984 and $1,453 per mile. These trails include paved, boardwalk, or other hardscaped trail surfaces.

High maintenance trails, which include hardscaped trails that run near of through cities and densely populated areas that also see high usage (178,000 users per year for the Pere Marquette Trail and 80,000 to 90,000 on the Kal-Haven Trail) have an estimated cost of $2,275 to $3,500 per mile. These costs cover weekly trash removal and toilet maintenance, tree removal, pruning, picnic table cleaning, graffiti removal, and pesticide spraying and invasive species removal.

Street Sweeping

Currently, there is no preferential treatment for streets with designated (separated or otherwise) bikeways. In the case of 8th Ave N (bike route), however, it is on a preferential schedule due to its nature as a snow route and a collector street.

Spring, Summer, and Fall

In the fair weather seasons in Great Falls, sweeping is done from west to east in the older City core (grid system), and then continues into the surrounding areas (e.g. south of 10th Ave S, and in the Riverview and Valley View neighborhoods). The Downtown core is on an enhanced schedule that includes 4 am sweeping so as to take advantage of the lack of motorized traffic and on-street parking (in commercial areas). Sweeping may also be performed as needed after heavy summer storms to clean up impacted areas (fallen branches, leaves, and other debris).

Winter

The City of Great Falls also sweeps in the winter in order to clear debris from the streets. It is done during breaks in the snowfall and preference is give (as mentioned before) to snow routes and arterials and collectors.

Montana Department of Transportation (MDT)

MDT sweeps all of the routes over which they have jurisdiction as needed. With the introduction of salt brine as a preventative measure, their sweeping has been cut down considerably. Although most sweeping is for spot improvements, maintenance crews do pay more attention to high usage routes such as 10th Ave S, 14th/15th St, and other major roadways.

On-street Snow Removal

The Great Falls area receives approximately 62 in of snow per year, receiving the most snow in March. The River's Edge Trail gets plowed before most streets because it is maintained by the Parks and Recreation Department, which is responsible for fewer routes than the Public Work Department, which maintains most roads.

3.5 Law Enforcement

As a matter of priority and utilizing manpower effectively, the Great Falls Police Department does not emphasize enforcement of bicycling laws as much as others. Because of a lack of available officers on duty, these infractions are usually overlooked.

3.6 Crashes

Bicyclists are typically at fault in the majority of crashes nationwide. This is often due to erratic and unsafe riding behavior including riding on the wrong side of the road, riding on sidewalks, and disobeying traffic control devices. Dedicated bicycling infrastructure such as bike lanes has been shown to improve behavior. This trend cannot be verified for Great Falls because there is not an "At Fault" option on Police reports when a crash occurs (at least not in the data provided).

For the period of January 1, 2008 through December 2010, there have been a total of 48 crashes involving bicycles in the City of Great Falls. Three of the 48 were between bicyclists and pedestrians; the remaining 45 were motor vehicle-bicycle crashes. Three of these 45 were alcohol-related; none of the three bicyclist-pedestrian crashes were alcohol-related. 37 of the 48 crashes (77 percent) occurred at intersections, driveways, roadway access points, or other junctions. Only two of the 48 crashes occurred during inclement weather, two occurred at dusk, and five happened at night. There have been no fatal crashes involving a bicyclist recorded in the Great Falls area since the beginning of 2008.

When crash data is visualized, most have occurred on or near major arterials, state, and U.S. routes such as 10th Ave S, 9th St, Central Ave, and 6th St SW.

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Bicycle Crashes

Great Falls Area Long Range Transportation Plan 2014

Legend

- Non-fatal Crash
- Existing Bike Lane
- Proposed Bike Lane
- Bike Routes
- Multi-use and Park Paths
- Unpaved Path
- Local Road
- Secondary Arterial
- Primary Arterial
- State Route
- Urban Route
- Non-Interstate Highway
- Highway or Freeway Ramp
- Interstate Highway
- Great Falls City Boundary
- Study Area

Dates: Jan 2008 to Dec 2010 (last crash)

alta PLANNING + DESIGN

0 0.25 0.5 1 Miles

Data obtained from City of Great Falls
Map created September 10, 2013

4 Walking

As stated previously, about 2.7 percent of commute trips to and from work in Great Falls are done on foot, and about 5.5 percent of all trips, regardless of type, are walking trips. Both of these figures are below state and national averages for commute trips and all trips, respectively. Great Falls' older core neighborhoods and grid street system with small blocks lend themselves to walking and non-motorized transportation.

4.1 Facilities and Programs

Pedestrians use sidewalks, trails, alleys, and bridges in and around Great Falls. Other than maintenance of sidewalks and other pedestrian facilities (either proprietary or shared with other users, like the River's Edge Trail), the City of Great Falls and Cascade County do not currently have any programs dedicated to encouraging walking.



Walking and jogging are very popular on the River's Edge Trail

The downtown core streets like 1st and 2nd Ave S have had multiple pedestrian improvements recently. Bulbouts (or curb extensions) and new street trees and plants have provided simplified and safer street crossings and a more inviting environment, respectively. Bulbouts also have the ability to calm or slow down traffic. This is important in a core commercial areas where walking is more prevalent (even by people who travel by car to get there).

Several non-governmental groups exist in Great Falls that are dedicated to encouraging more active and fit residents, including Recreational Trails, Inc. (discussed previously) and Get Fit Great Falls (GFGF), a group that desires to have a healthier and more active community that is also more economically vibrant and physically active. Get Fit Great Falls is made up of representatives from 20 community organizations and agencies and although it is not officially a non-profit organization, it has been successful in its initial initiatives to encourage more walking and bicycling to Great Falls Voyagers baseball games, overall walkability of the City, and improving the relationship between pedestrians and other roadway users. Bicyclists and pedestrians sharing sidewalks can be dangerous according to GFGF and an improvement on the current situation is another goal of the organization. Focusing also on wheelchair accessibility and safety concerns for disabled users, GFGF has sought to work with the City to close sidewalk gaps and improve ADA access. Gaps in the pedestrian network and an analysis of needs will be provided later.

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Existing Pedestrian Conditions

Great Falls Area Long Range Transportation Plan 2014

Legend

- Sidewalk Gaps
- Multi-use and Park Paths
- Unpaved Path
- Local
- Secondary Arterial
- Primary Arterial
- State Route
- Urban Route
- Non-Interstate Highway
- Highway or Freeway Ramp
- Interstate Highway
- Great Falls City Boundary
- Study Area
- Areas with poor sidewalk connectivity

Note: Sidewalk gaps are shown only on the major roadway network (collectors, artierials, state and U.S. routes, and interstate highways). Areas with poor sidewalk connectivity are highlighted.

alta PLANNING + DESIGN

0 0.25 0.5 1 Miles

Data obtained from City of Great Falls
Map created September 10, 2013

Existing ADA Sidewalk Ramps

Great Falls Area Long Range Transportation Plan 2014

Legend

- ADA Ramps
- Local
- Secondary Arterial
- Primary Arterial
- State Route
- Urban Route
- Non-Interstate Highway
- Highway or Freeway Ramp
- Interstate Highway
- Great Falls City Boundary
- Study Area

alta PLANNING + DESIGN

0 0.25 0.5 1 Miles

Data obtained from City of Great Falls
Map created September 10, 2013

4.2 Sidewalk Maintenance

Within the Great Falls city limits, there are no programs for sidewalk maintenance or replacement. Many Montana communities also have sidewalk networks that are fragmented, disconnected, and poorly maintained. This is due, in large part, to minimal sidewalk infrastructure required as part of 1970s and 1980s era development.

The presence of sidewalks along streets and in neighborhoods can have a dramatic impact on physical activity levels of residents and the transportation options available to the community. According to the National Complete Streets Coalition, 43 percent of people with safe places to walk within 10 minutes of home meet recommended activity levels, whereas only 27 percent of people without safe places to walk meet these activity levels. Furthermore, residents were found to be 65 percent more likely to walk in a neighborhood with sidewalks[10].

One well-documented Montana example echoes the National Complete Streets Coalition's findings. The City of Bozeman performed a video monitoring program of West Babcock Street before and after a reconstruction. Following the addition of sidewalks, the study noted an immediate 273 percent increase in pedestrian activity[11].

Often the biggest hurdle for communities is coming up with ways to fund sidewalk infill projects. Typically, available funding for sidewalk construction and maintenance in operational budgets is scarce. In many communities this is because sidewalk construction and maintenance is the legal responsibility of the adjacent property owner (in the case of existing development) or the developer (in the case of new development). Local ordinance and subdivision regulations typically govern sidewalk installation and maintenance responsibilities.

Per Montana state law, sidewalk maintenance including tree root heaves, crumbling, etc., is the responsibility of the adjoining property owner(s) and is only enforced by the City or the jurisdictional authority. In the case of sidewalks inside of Great Falls city limits, this authority would be the City. Otherwise, it would be Cascade County. At the City level, at least, this process is complaint-driven and is thus reactive, and not proactive. After receiving a hazardous sidewalks complaint, a member of the City's Engineering Department staff performs a site inspection to determine if it is, in fact, a condemnable defect. If that is the case, a letter is then issued to the property owner notifying them of the defect and that they will be allowed 30 days for repairs. In 90 percent of cases, according to the City of Great Falls, the owner complies and the defect is remedied. The remaining 10 percent require a condemnation process that continues with the City hiring a contractor to do the repairs and the owner being charged for any labor and materials needed. If the owner does not pay for the repairs after they have been completed, then a lien is place on the property.

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[10] *"Health | Smart Growth America." National Complete Streets Coalition | Smart Growth America. Web. 6 Aug. 2013. <http://www.completestreets.org/complete-streets-fundamentals/factsheets/health/>.*

[11] *"2005-2006 West Babcock Street Pedestrian and Bicyclist Monitoring Project Final Report." Bozeman Planning and Community Development. Web. 7 Aug. 2013. <http://www.bozeman.net/Smarty/files/73/732447ea-e1cf-4764-ad7f-8cf0b960e8e9.pdf>.*

In some cases where the defect is very minor, like small rises (usually less than one inch) in sidewalks sections that turn into "toe stubbers", especially in Downtown, grinding the concrete level has been done. Grinding, however, is limited to very minor offsets and to strong or newer concrete because old or deteriorated concrete tends to shatter.

In rare cases, the City or MDT has paid for sidewalk replacement or repair in full when it was part of a larger project, like the addition of ADA ramps, asphalt milling, and overlay projects on 1st and 2nd Ave N.

For the Montana Department of Transportation (MDT), their involvement in the issue depends on the extent of the repair required by the offset or deterioration. Their rule of thumb is that if is more than six linear feet of repair, then they will consider it more than "maintenance" and will fix it with public funds. Even with this program, businesses have also fixed larger repairs on their own.

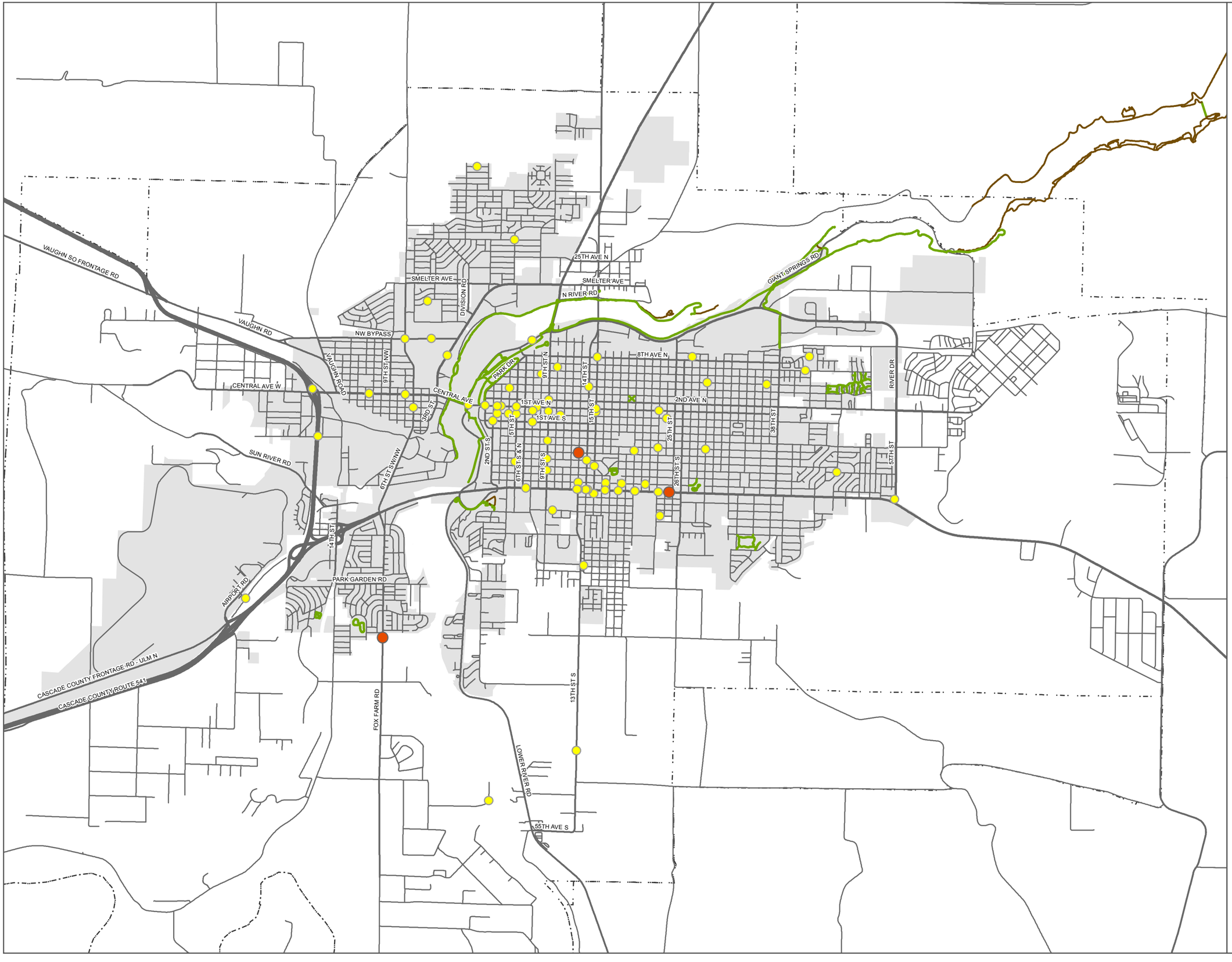
4.3 Crashes

There have been 88 total pedestrian-related crashes recorded between January 1, 2008 and December 2012 in the City of Great Falls. Seven of them were alcohol-related, with two of the seven proving fatal. 48 of the 88 total were at intersections, driveways, roadway access points, or were otherwise intersection-related. Only three of the 88 occurred during inclement weather, three were during dusk, and 28 at night (either on a lighted or unlit street).

Like bicycle-related crashes, there is a concentration of pedestrian crashes on or near major arterial roadways, state and U.S. routes (e.g. 10th Ave S between 13th St S and 26th St S; 9th St South; 15th St; and in Downtown between 1st Ave N and 1st Ave S).

Fatal Crashes

All three total fatal crashes since the beginning of 2008 occurred between midnight and 8:00 am. In these crashes, at least one pedestrian was killed while none of the motorists were killed. Alcohol played a factor in two of the three crashes.



Pedestrian Crashes

Great Falls Area Long Range Transportation Plan 2014

Legend

- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash
- Multi-use and Park Paths
- Unpaved Path
- Local
- Secondary Arterial
- Primary Arterial
- State Route
- Urban Route
- Non-Interstate Highway
- Highway or Freeway Ramp
- Interstate Highway
- Great Falls City Boundary
- Study Area

Dates: Jan 2008 to Dec 2012 (last crash)

alta PLANNING + DESIGN

0 0.25 0.5 1 Miles

Data obtained from City of Great Falls
Map created September 10, 2013

5 Connectivity to Transit

Trips by transit (in Great Falls' case, by bus) often begin and end on foot or bicycle or both. When connectivity to transit is poor, ridership and ease of use of the system is also negatively affected. By improving sidewalks at and near bus stops, constructing bus shelters for waiting patrons, and planning routes near popular bicycling and walking routes, citizen connectivity to transit can improve.

Currently, the Great Falls Transit District (GFTD) bus route network is mostly a flag-down system, but there are plans and programs now in place to include fixed stops and the amenities that go along with them. A completely fixed stop system has been discussed internally at GFTD, but a plan for implementation has not been created yet. The advantages of a fixed stop system, especially for bicyclists and pedestrians, would be, among others, improved predictability of route time tables and scheduling, both for the user and the Transit District.

Overall ridership in the last year has increased and always goes up during the school year.

Bicycling

Nearly all GFTD buses now have bike racks mounted on the front of the bus that allow users to use buses to connect longer legs of a trip, in case of an emergency or breakdown, or to avoid inclement weather or difficult topography. GFTD has not, however, tracked or counted their use to determine demand on certain routes, or where bicyclists board and alight most.

Walking

The GFTD is currently focused heavily on addressing connectivity to newly implemented fixed stops via sidewalks and applicable improvements.

The City's Planning Department expressed interest in seeing GFTD provide a priority analysis on Safe Routes to Schools and sidewalks and their relationship with transit accessibility. According to the City and GFTD, there are transit users with limited mobility who use paratransit and other transit services because there are not sidewalks where they want to go or that access traditional bus stops and not necessarily because they require a paratransit ride.

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6 Needs Analysis

6.1 System Deficiencies

Overview

Even though the River's Edge Trail provides a high-quality backbone to the community's transportation system, the active transportation network of bikeways and pedestrian facilities is still lacking significantly, especially connections between that network (proposed and existing) and the River's Edge Trail. Access from Downtown to the trail (and vice versa) is limited. Several other features in Great Falls, like the Missouri River 10th Ave S bridge, were designed and constructed without consideration for active transportation modes. Existing sidewalk gaps and the attitude and perception of motorists towards other modes also pose significant barriers to walking and bicycling being perceived and utilized as legitimate forms of transportation.

Sidewalk Gaps

Most of the established areas of Great Falls have a very cohesive and continuous sidewalk network. On the outskirts and in new or fringe developments, however, such connectivity is lacking. Much of the latter areas were subdivided and built before being incorporating into the City (if at all), and most of the sidewalk gaps occur here. Developers and builders in unincorporated areas were not required to build sidewalks and they weren't included in the design of these neighborhoods.

There are currently 37.62 miles of sidewalk gaps out of the 196 miles of potential sidewalk mileage within the City limits. This means that slightly less than 20 percent of the potential total mileage for sidewalks (assuming they would be installed on every non-Interstate system street within the City limits) is still missing.

According to the public survey regarding walking in Great Falls, 44 percent of those surveyed believe that the sidewalk network near their home is complete, while 33 percent said that it was mostly complete. Only 8 percent of those surveyed live in an area where sidewalks are spotty at best and 15 percent live where there are no sidewalks at all. Additionally, 71 percent of respondents rated the present quality of pedestrian infrastructure in Great Falls as "Fair".



There are some locations in Great Falls where sidewalks end



Some streets don't have any sidewalks

ADA Ramps

An ADA ramp is an inclined ramp that allows access for those in wheelchairs, with other disabilities (including the elderly), and those pushing carts or strollers to transition gradually and safely between the sidewalk and the street, similar to the way a driveway curb cut allows a car to access a driveway and the roadway.

The City of Great Falls has made a significant effort is creating curb ramps or ADA ramps in recent years.

The Great Falls Transit District ADA (Americans with Disabilities Act) advisory committee is currently without effective guidance or leadership, but its role has traditionally been to advise the Board of Trustees or Directors on issues regarding wheelchair access and accommodating and providing services for those with disabilities who use the transit system. In the past, their priority was a curb cut, or ADA ramp, program. Once that began to pick up speed and more ADA ramps were installed on sidewalks, interested members of that committee dwindled and stopped coming to meetings.

6.2 Public Meetings

Consultants from Robert Peccia & Associates and Alta Planning + Design met with stakeholders of the project and with the public in June 2013. The overall sentiment throughout each of the meetings was positive and encouraging. Representatives from governments, non-profits, trails groups, bicycling advocacy groups, and health and recreational organizations were supportive of walking and bicycling as a way to contribute to the local economy, provide mobility and safe transportation choices for Great Falls area residents, and build upon and create a world class trail system.

Stakeholder Meetings

Consultants met with the following groups during the stakeholder meetings: Get Fit Great Falls, Great Falls Transit District, Great Falls Public Work Department, Montana Department of Transportation, River's Edge Trail (Recreational Trails, Inc.), and the City's Trails Working Group.

Citizens and community groups that met with consultants have specific projects and broad or general goals that they would like to see implemented over coming years. Government representatives would like to implement the same and desire a plan that not only suggests visionary improvements to bicycling and walking in the area but also provides a plan for implementation so that the area is not left with disjointed bikeways as experiments, sidewalks without connectivity to key destinations, or facilities that are less safe than they should be. With such a plan, all parties agree that there will be a vision to follow and with which all parties can move forward.

Public Open House #1

At the first public open house for the Great Falls Area Long Range Transportation Plan there were more than 30 in attendance not including City and State government representatives and the project consultants. Attendees were members of the public, representatives from non-profit organizations, avid bicyclists, potential and interested bicyclists and pedestrians, and some with ideas on how to best implement the plan.

After a presentation about the "why" behind the plan, attendees participating in two mapping stations: one dedicated to all roadways and traffic improvements, and one specifically for walking and bicycling. The comments received at these mapping stations (including the maps themselves) reflect the attendees' desired improvements for the City.

6.3 Survey Summary

Bicycling

A public survey was created as part of the active transportation section of this plan in order to collect information about the preferences and key identifiers of different types of people interested in bicycling in the Great Falls area. Of the 298 total respondents to the "Bicycling Survey", 152 of them (52 percent) were women, while 142 (48 percent) were men.

The survey was not statistically valid (because of the reach and response) and was distributed and promoted primarily by stakeholder groups in the transportation planning process and advertised in the newspaper.

Age

28 percent (the largest group of respondents by age) were between 50 and 59 years old. In total, there were only two respondents under 20 years old.

Education

The most common response when asked about the highest level of education acquired was "Bachelor Degree" with 41 percent of respondents having achieved this level. The next most common response was "Graduate Degree".

Income

There was a fairly even split between income levels among those surveyed, with about 20-25 percent in each level, except for the $0-$24,999 range, which only had 5 percent of the total respondents. The other levels were: $25,000-$49,999; $50,000-$74,999; $75,000-$99,999; and $100,000 and above.

Types of Bicyclists

It is important to consider bicyclists of all skill levels when creating a non-motorized plan or project. Bicyclist skill level greatly influences expected speeds and behavior, both in separated bikeways and on shared roadways. Bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people. The bicycle planning and engineering professions currently use several systems to classify the population, which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The most conventional framework classifies the "design cyclist" as *'Experienced and Confident' or 'Casual and Less Confident'*.[12] A more detailed understanding of the US population

[12] *Guide for the Development of Bicycle Facilities, 4th Edition. (2012). AASHTO.*

as a whole was developed by planners in Portland, OR[13] and supported by data collected nationally since 2005. This classification provides the following alternative categories to address varying attitudes towards bicycling in the US:

Strong and Fearless (approximately 1 percent of population)

Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles - over separate bikeways such as shared use paths.

Enthused and Confident (5-10 percent of population)

This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

Interested but Concerned (approximately 60 percent of population)

This user type comprises the bulk of the population and represents bicyclists who typically only ride on low traffic streets or shared use paths under favorable weather conditions. These people perceive significant barriers to increased cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.

No Way, No How (approximately 30 percent of population)

Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances.

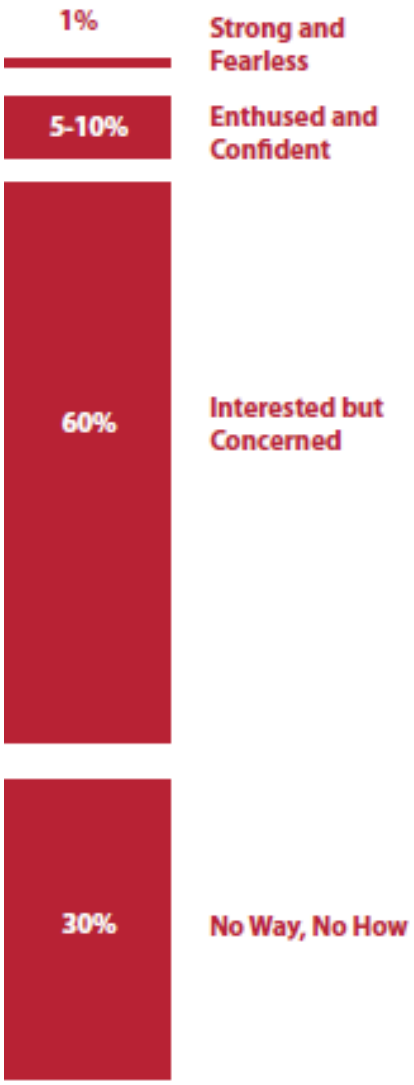


Figure 3: Typical Distribution of Bicyclist Types

[13] *Four Types of Cyclists. (2009). Roget Geller, City of Portland Bureau of Transportation. http://www.portlandonline.com/transportation/index.cfm?c&a=237507*

When considering responses from all 298 respondents, they all self-identified as the following types of bicyclists or potential bicyclists:

- Strong and Fearless: 19 percent
- Enthused and Confident: 39 percent
- Interested but Concerned: 34 percent
- No way No how: 8 percent

The 8 percent (or 25 people) who chose the last category not only identified themselves as those who do not and will not ride a bicycle but they also, for the most part, also opposed bicycle infrastructure of any kind and often stated that bicyclists should pay for bike lanes themselves via licensing fees or that federal or state money should be used instead of local money. Only four of the 25 said that local money should be used in concert with state and federal funds.

44 percent of the 152 female respondents answered that they were bicyclists or potential bicyclists that were "Interested but Concerned", whereas only 23 percent of the 142 male respondents considered themselves part of this type of bicyclist. The most common type of self-identified male bicyclist was the "Enthused and Confident" type (38.5 percent of the 142).

"Strong and Fearless" male bicyclists came a close second at 31 percent of the 142 respondents. Interestingly, only 7 percent of females surveyed identified themselves in this category.

Preferred Facilities

Survey takers were given the chance to select which facilities and types of bikeways they preferred or wished to have in their community (on a scale of 1-5, with one being least desirable and five being the most, depending on how much they liked it and how desirable it was). Most of the bikeways types received an average score of 3.5, but shared use paths received a 4.3, which is indicative of the fact that Great Falls residents are familiar with this type of facility (River's Edge Trail) and may not be familiar with other types.

Destinations

When asked what their normal destinations are in Great Falls, respondents showed that trails, open space, and community spaces are among the most visited and cherished. The top 5 destinations among respondents were:

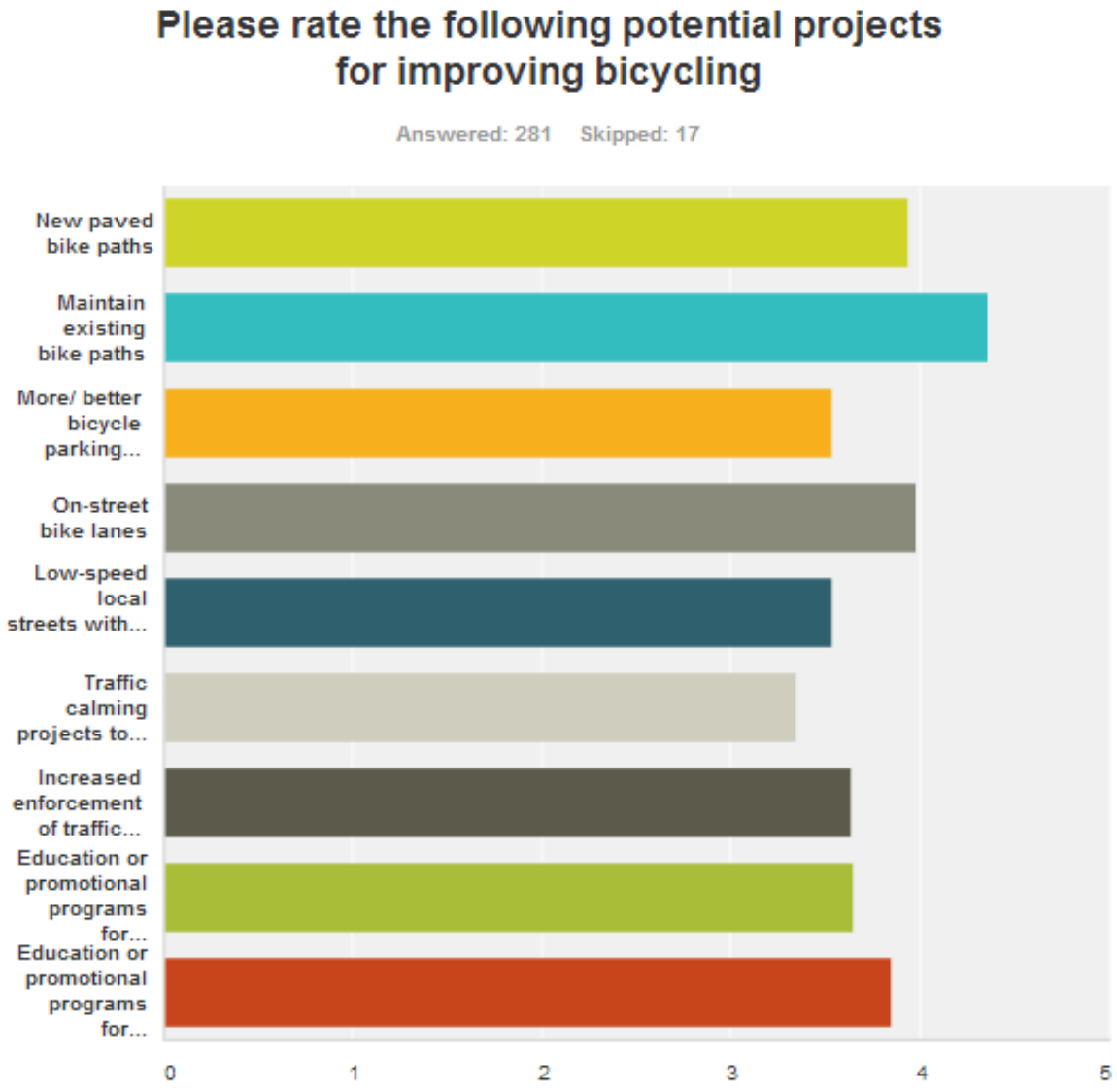
- River's Edge Trail
- Downtown Great Falls
- Gibson Park
- Giant Springs Interpretive Center
- Riverfront parks

Funding

An overwhelming majority of those surveyed believe that local funds should be prioritized and complement existing State or Federal funds in order to provide bicycle facilities. 66 percent of them said that they would be willing to pay more taxes, pay more in street assessments, or by local bond to implement a bicycle network more quickly.

Improving Bicycling

When asked what methods they would prefer in order to improve bicycling in Great Falls, the only choice that received a higher score than 4 (on a scale of 1 to 5), was "Maintain existing bike paths" with all other options receiving an average score of 3.6, the lowest being 3.34 ("Traffic calming to slow cars"). This does not mean that survey respondents don't want bicycling improvements and different methods to accomplish a cohesive system, but it does mean that improving maintenance of existing facilities, especially paths and trails, is the number one priority for them right now.



Walking

A public survey dealing with walking and the preferences of pedestrians in the Great Falls area ran concurrently with the Bicycling Survey discussed previously. A total of 192 responses from Great Falls area residents were gathered. Of these 192 people surveyed, 116 (61%) of them were women, while 75 (39%) were men.

Age, Education, and Income

The age, education, and income characteristics for this survey were nearly identical to the Bicycling Survey.

Walking Habits

In addition to demographic information, respondents were also asked about their walking habits. About half (49 percent) of respondents walk a few times per week, the next most common response was "5+ times per week" with only a cumulative 10 percent of respondents saying that they walk a few times per month or never.

Most respondents walk primarily for exercise and the next reasons are, in this order: spending time outdoors, transportation to a destination, social visits, and walking to school.

An overwhelming amount of people surveys responded that they currently enjoy walking on the River's Edge Trail, with the next most popular responses being "riverfront parks", "Downtown Great Falls", and "grocery stores".

Proximity to Destinations

Nearly 50 percent of respondents say that it only takes one to five minutes to walk to a park or playground, 30 percent have a 6-10 minute walk to a small grocery store, and 35 percent have an 11-20 minute walk to a supermarket. There was an even split of about 18 percent of respondents who lived 21-30 minutes walking from a supermarket, fast food restaurant, pharmacy, or trail or greenway. Only 10 percent of respondents lived within a one to five minute walk from a trail or greenway.

Sidewalk Network

44 percent of the 192 respondents believe that the sidewalk network near their home is complete. Additional analysis of this section of the Walking Survey is provided in earlier in section 6 of this memorandum.

Preference

70 percent of respondents said that they would walk more often if there were more sidewalks, greenway trails, and safe roadway crossings (in that order) according to the preference survey question.

Automobile speed & traffic, lack of sidewalks & trails, and a lack of pedestrian crossings at intersections were the top 3 reasons why people surveyed choose not to walk. Connectivity was also a big draw for respondents who said that they would like to see more pedestrian connectivity between neighborhood, shopping centers, park, and other destinations more than any other improvement. Marked crosswalks and sidewalks rounded out the top three.

Interestingly, 10th Ave S and Fox Farm Rd seemed to pop up more than others in open-ended questions that asked for additional thoughts on locations or corridors that could be improved for pedestrians. Respondents cited these as routes and barriers that were difficult to use and were unattractive as a pedestrian.

Appendix B

Existing Intersection Operations

Intersection Level Of Service Report
Intersection 1: 57th St S and 2nd Ave N

Control Type:	Signalized	Delay (sec / veh):	21.0
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.270

Intersection Setup

Name											
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	0	1	0	0
Pocket Length [ft]	250.00	100.00	100.00	230.00	100.00	250.00	200.00	100.00	100.00	400.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	38	179	152	24	115	23	49	197	42	92	83	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	38	179	152	24	115	23	49	197	42	92	83	16
Peak Hour Factor	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930	0.8930
Other Adjustment Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9180	0.9180	0.9180	0.9640	0.9640	0.9640
Total 15-Minute Volume [veh/h]	10	48	41	6	31	6	13	51	11	25	22	4
Total Analysis Volume [veh/h]	41	193	164	26	124	25	50	203	43	99	90	17
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	2	1	6	0	3	8	0	7	4	0
Auxiliary Signal Groups			2									
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	0	5	15	0	5	15	0
Maximum Green [s]	20	45	45	20	45	0	20	45	0	20	45	0
Amber [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	11	35	35	10	34	0	12	27	0	18	33	0
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Minimum Recall	No	No	No	No	No		No	No		No	No	
Maximum Recall	No	No	No	No	No		No	No		No	No	
Pedestrian Recall	No	No	No	No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	R	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	90	90	90	90	90	90	90	90	90	90	90	90
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	54	46	46	54	46	46	26	15	15	26	18	18
g / C, Green / Cycle	0.60	0.52	0.52	0.60	0.51	0.51	0.29	0.17	0.17	0.29	0.20	0.20
(v / s)_i Volume / Saturation Flow Rate	0.04	0.12	0.12	0.02	0.05	0.05	0.04	0.08	0.08	0.08	0.03	0.04
s, saturation flow rate [veh/h]	1157	1550	1318	1112	1550	1463	1238	1550	1459	1180	1550	1467
c, Capacity [veh/h]	772	798	678	699	784	740	443	259	244	383	303	287
d1, Uniform Delay [s]	7.55	12.13	12.13	7.68	11.59	11.61	23.48	34.03	34.12	24.54	30.26	30.30
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.13	0.72	0.84	0.02	0.24	0.27	0.11	1.39	1.56	0.35	0.28	0.31
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.05	0.24	0.24	0.04	0.10	0.10	0.11	0.48	0.50	0.26	0.18	0.18
d, Delay for Lane Group [s/veh]	7.68	12.85	12.98	7.70	11.83	11.88	23.59	35.42	35.68	24.89	30.54	30.61
Lane Group LOS	A	B	B	A	B	B	C	D	D	C	C	C
Critical Lane Group	No	Yes	No	Yes	No	No	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.33	2.20	1.89	0.19	0.80	0.79	0.78	2.54	2.48	1.62	0.99	0.97
50th-Percentile Queue Length [ft/ln]	8.26	54.88	47.23	4.85	20.03	19.77	19.59	63.57	61.95	40.40	24.77	24.31
95th-Percentile Queue Length [veh/ln]	0.59	3.95	3.40	0.35	1.44	1.42	1.41	4.58	4.46	2.91	1.78	1.75
95th-Percentile Queue Length [ft/ln]	14.87	98.79	85.01	8.73	36.05	35.58	35.25	114.43	111.52	72.71	44.58	43.77

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	7.68	12.85	12.98	7.70	11.85	11.88	23.59	35.52	35.68	24.89	30.57	30.61
Movement LOS	A	B	B	A	B	B	C	D	D	C	C	C
d_A, Approach Delay [s/veh]	12.37			11.24			33.53			27.84		
Approach LOS	B			B			C			C		
d_I, Intersection Delay [s/veh]	20.98											
Intersection LOS	C											
Intersection V/C	0.270											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	36.45	36.45	36.45	36.45
l_p,int, Pedestrian LOS Score for Intersection	2.562	2.254	2.420	2.438
Crosswalk LOS	B	B	B	B
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	667	644	489	622
d_b, Bicycle Delay [s]	20.00	20.67	25.69	21.36
l_b,int, Bicycle LOS Score for Intersection	2.216	1.704	1.804	1.730
Bicycle LOS	B	A	A	A

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: 57th St S and 2nd Ave N

Control Type:	Signalized	Delay (sec / veh):	21.7
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.321

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	0	1	0	0
Pocket Length [ft]	250.00	100.00	100.00	230.00	100.00	250.00	200.00	100.00	100.00	400.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	54	158	115	19	226	69	24	82	52	224	274	57
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	54	158	115	19	226	69	24	82	52	224	274	57
Peak Hour Factor	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730
Other Adjustment Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9180	0.9180	0.9180	0.9640	0.9640	0.9640
Total 15-Minute Volume [veh/h]	15	44	32	5	62	19	6	22	14	62	76	16
Total Analysis Volume [veh/h]	60	174	127	21	250	76	25	86	55	247	303	63
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	2	1	6	0	3	8	0	7	4	0
Auxiliary Signal Groups			2									
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	0	5	15	0	5	15	0
Maximum Green [s]	20	45	45	20	45	0	20	45	0	20	45	0
Amber [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	10	21	21	10	21	0	11	21	0	38	48	0
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Minimum Recall	No	No	No	No	No		No	No		No	No	
Maximum Recall	No	No	No	No	No		No	No		No	No	
Pedestrian Recall	No	No	No	No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	R	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	90	90	90	90	90	90	90	90	90	90	90	90
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	47	39	39	47	38	38	34	15	15	34	26	26
g / C, Green / Cycle	0.52	0.44	0.44	0.52	0.42	0.42	0.37	0.16	0.16	0.37	0.29	0.29
(v / s)_i Volume / Saturation Flow Rate	0.06	0.11	0.10	0.02	0.11	0.11	0.02	0.05	0.05	0.19	0.12	0.12
s, saturation flow rate [veh/h]	1027	1550	1318	1132	1550	1430	1005	1550	1359	1301	1550	1459
c, Capacity [veh/h]	570	678	576	615	646	596	400	253	221	552	451	424
d1, Uniform Delay [s]	11.29	16.10	15.82	10.97	17.20	17.27	18.47	33.15	33.30	21.40	25.83	25.86
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.37	0.92	0.88	0.02	0.97	1.10	0.06	0.61	0.79	0.57	0.62	0.66
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.11	0.26	0.22	0.03	0.26	0.27	0.06	0.29	0.31	0.45	0.42	0.42
d, Delay for Lane Group [s/veh]	11.66	17.02	16.70	10.99	18.17	18.37	18.54	33.77	34.10	21.97	26.44	26.52
Lane Group LOS	B	B	B	B	B	B	B	C	C	C	C	C
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.63	2.36	1.71	0.20	2.36	2.27	0.33	1.41	1.36	3.89	3.26	3.10
50th-Percentile Queue Length [ft/ln]	15.87	59.10	42.82	5.00	59.03	56.86	8.34	35.22	34.08	97.33	81.41	77.46
95th-Percentile Queue Length [veh/ln]	1.14	4.26	3.08	0.36	4.25	4.09	0.60	2.54	2.45	7.01	5.86	5.58
95th-Percentile Queue Length [ft/ln]	28.57	106.38	77.07	9.00	106.25	102.34	15.01	63.39	61.34	175.20	146.54	139.43

Movement, Approach, & Intersection Results

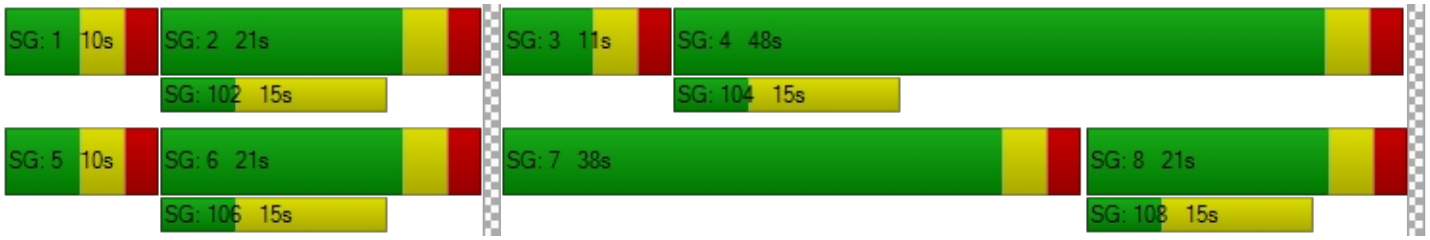
d_M, Delay for Movement [s/veh]	11.66	17.02	16.70	10.99	18.24	18.37	18.54	33.82	34.10	21.97	26.47	26.52
Movement LOS	B	B	B	B	B	B	B	C	C	C	C	C
d_A, Approach Delay [s/veh]	16.02			17.83			31.61			24.66		
Approach LOS	B			B			C			C		
d_I, Intersection Delay [s/veh]	21.74											
Intersection LOS	C											
Intersection V/C	0.321											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	36.45	36.45	36.45	36.45
l_p,int, Pedestrian LOS Score for Intersection	2.616	2.292	2.457	2.480
Crosswalk LOS	B	B	B	B
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	356	356	356	956
d_b, Bicycle Delay [s]	30.42	30.42	30.42	12.27
l_b,int, Bicycle LOS Score for Intersection	2.155	1.846	1.697	2.065
Bicycle LOS	B	A	A	B

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: 10th Ave S and 20th St S

Control Type:	Signalized	Delay (sec / veh):	14.2
Analysis Method:	HCM 6th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.464

Intersection Setup

Name											
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	275.00	100.00	100.00	275.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	57	40	48	51	64	31	12	1226	153	31	1159	38
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	3.60	7.50	4.20	2.00	1.60	3.20	0.00	4.70	2.70	3.20	2.60	2.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	57	40	48	51	64	31	12	1226	153	31	1159	38
Peak Hour Factor	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320	0.8320
Other Adjustment Factor	0.8550	0.8550	0.8550	0.8550	0.8550	0.8550	0.8660	0.8660	0.8660	0.8660	0.8660	0.8660
Total 15-Minute Volume [veh/h]	15	10	12	13	16	8	3	319	40	8	302	10
Total Analysis Volume [veh/h]	59	41	49	52	66	32	12	1276	159	32	1206	40
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	130
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	2	0	0	6	0	0	8	0	0	4	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	30	0	0	30	0	0	60	0	0	60	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	36	0	0	36	0	0	94	0	0	94	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	130	130	130	130	130	130	130	130	130
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	31	31	31	89	89	89	89	89	89
g / C, Green / Cycle	0.24	0.24	0.24	0.68	0.68	0.68	0.68	0.68	0.68
(v / s)_i Volume / Saturation Flow Rate	0.05	0.07	0.13	0.03	0.33	0.33	0.10	0.28	0.28
s, saturation flow rate [veh/h]	1152	1352	1141	408	2887	1432	332	2937	1517
c, Capacity [veh/h]	154	322	309	278	1977	980	225	2011	1039
d1, Uniform Delay [s]	43.51	40.38	45.21	13.76	9.68	9.68	17.11	8.98	8.98
k, delay calibration	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	7.04	2.15	5.36	0.29	0.86	1.72	1.32	0.62	1.19
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.38	0.28	0.48	0.04	0.49	0.49	0.14	0.41	0.41
d, Delay for Lane Group [s/veh]	50.54	42.53	50.57	14.05	10.54	11.40	18.42	9.59	10.17
Lane Group LOS	D	D	D	B	B	B	B	A	B
Critical Lane Group	No	No	Yes	No	No	Yes	No	No	No
50th-Percentile Queue Length [veh/ln]	1.98	2.57	4.84	0.19	6.34	6.53	0.60	5.02	5.36
50th-Percentile Queue Length [ft/ln]	49.45	64.15	121.05	4.73	158.58	163.17	15.10	125.55	133.91
95th-Percentile Queue Length [veh/ln]	3.56	4.62	8.45	0.34	10.47	10.72	1.09	8.70	9.15
95th-Percentile Queue Length [ft/ln]	89.01	115.46	211.26	8.51	261.84	267.92	27.18	217.43	228.81

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	50.54	42.53	42.53	50.57	50.57	50.57	14.05	10.75	11.40	18.42	9.78	10.17
Movement LOS	D	D	D	D	D	D	B	B	B	B	A	B
d_A, Approach Delay [s/veh]	45.71			50.57			10.85			10.01		
Approach LOS	D			D			B			B		
d_I, Intersection Delay [s/veh]	14.18											
Intersection LOS	B											
Intersection V/C	0.464											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	56.31	56.31	56.31	56.31
l_p,int, Pedestrian LOS Score for Intersection	2.137	1.869	3.079	3.057
Crosswalk LOS	B	A	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	477	477	1369	1369
d_b, Bicycle Delay [s]	37.70	37.70	6.47	6.47
l_b,int, Bicycle LOS Score for Intersection	1.805	1.807	2.355	2.263
Bicycle LOS	A	A	B	B

Sequence

Ring 1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: 10th Ave S and 20th St S

Control Type:	Signalized	Delay (sec / veh):	21.9
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.535

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	275.00	100.00	100.00	275.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	227	62	90	52	65	42	17	1449	114	36	1764	27
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.40	0.00	1.10	0.00	0.00	2.40	0.00	1.90	0.00	0.00	1.90	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	227	62	90	52	65	42	17	1449	114	36	1764	27
Peak Hour Factor	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510	0.9510
Other Adjustment Factor	0.8550	0.8550	0.8550	0.8550	0.8550	0.8550	0.8660	0.8660	0.8660	0.8660	0.8660	0.8660
Total 15-Minute Volume [veh/h]	51	14	20	12	15	9	4	330	26	8	402	6
Total Analysis Volume [veh/h]	204	56	81	47	58	38	15	1319	104	33	1606	25
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	115
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	2	0	0	6	0	0	8	0	0	4	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	30	0	0	30	0	0	60	0	0	60	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	46	0	0	46	0	0	69	0	0	69	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	115	115	115	115	115	115	115	115	115
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	41	41	41	64	64	64	64	64	64
g / C, Green / Cycle	0.36	0.36	0.36	0.56	0.56	0.56	0.56	0.56	0.56
(v / s)_i Volume / Saturation Flow Rate	0.17	0.10	0.12	0.05	0.32	0.32	0.10	0.36	0.36
s, saturation flow rate [veh/h]	1184	1426	1172	282	2954	1494	344	2954	1539
c, Capacity [veh/h]	313	508	459	143	1644	831	176	1644	857
d1, Uniform Delay [s]	35.56	26.34	28.52	30.93	16.63	16.63	28.50	17.75	17.75
k, delay calibration	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	10.16	1.30	1.76	1.46	1.47	2.88	2.33	2.03	3.85
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.65	0.27	0.31	0.10	0.57	0.57	0.19	0.65	0.65
d, Delay for Lane Group [s/veh]	45.72	27.64	30.28	32.39	18.10	19.51	30.84	19.78	21.60
Lane Group LOS	D	C	C	C	B	B	C	B	C
Critical Lane Group	Yes	No	No	No	No	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	5.94	2.86	3.29	0.37	8.17	8.60	0.79	9.96	10.81
50th-Percentile Queue Length [ft/ln]	148.39	71.55	82.19	9.34	204.36	214.90	19.74	248.95	270.35
95th-Percentile Queue Length [veh/ln]	9.93	5.15	5.92	0.67	12.86	13.40	1.42	15.13	16.21
95th-Percentile Queue Length [ft/ln]	248.28	128.79	147.95	16.82	321.59	335.11	35.53	378.33	405.17

Movement, Approach, & Intersection Results

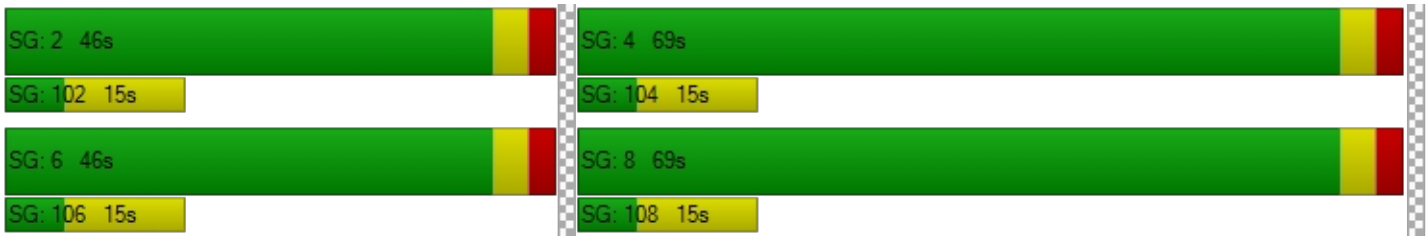
d_M, Delay for Movement [s/veh]	45.72	27.64	27.64	30.28	30.28	30.28	32.39	18.50	19.51	30.84	20.39	21.60
Movement LOS	D	C	C	C	C	C	C	B	B	C	C	C
d_A, Approach Delay [s/veh]	38.46			30.28			18.72			20.61		
Approach LOS	D			C			B			C		
d_I, Intersection Delay [s/veh]	21.93											
Intersection LOS	C											
Intersection V/C	0.535											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	48.85	48.85	48.85	48.85
l_p,int, Pedestrian LOS Score for Intersection	2.175	1.866	3.355	3.107
Crosswalk LOS	B	A	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	713	713	1113	1113
d_b, Bicycle Delay [s]	23.81	23.81	11.31	11.31
l_b,int, Bicycle LOS Score for Intersection	2.122	1.796	2.351	2.475
Bicycle LOS	B	A	B	B

Sequence

Ring 1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 3: 10th Ave S and 6th St SW/Fox Farm Rd

Control Type:	Signalized	Delay (sec / veh):	37.6
Analysis Method:	HCM 6th Edition	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.894

Intersection Setup

Name												
Approach	Northbound			Southbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	1	2	0	1
Pocket Length [ft]	150.00	100.00	100.00	500.00	100.00	300.00	300.00	100.00	300.00	525.00	100.00	500.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	159	98	136	47	191	421	133	395	130	157	740	48
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.40	3.06	5.88	4.26	1.05	0.48	1.50	4.30	2.31	3.82	5.14	6.25
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	159	98	136	47	191	421	133	395	130	157	740	48
Peak Hour Factor	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630	0.8630
Other Adjustment Factor	0.8670	0.8670	0.8670	0.8750	0.8750	0.8750	0.8890	0.8890	0.8890	0.8750	0.8750	0.8750
Total 15-Minute Volume [veh/h]	40	25	34	12	48	107	34	102	33	40	188	12
Total Analysis Volume [veh/h]	160	98	137	48	194	427	137	407	134	159	750	49
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	110
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap
Signal group	5	2	2	1	6	6	3	8	8	7	4	4
Auxiliary Signal Groups			2			6			8			4
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	15	5	15	15	5	15	15
Maximum Green [s]	15	60	60	20	60	60	20	60	60	20	60	60
Amber [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All red [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Split [s]	10	20	20	12	22	22	17	20	20	58	61	61
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Walk [s]	0	5	5	0	5	5	0	5	5	0	5	5
Pedestrian Clearance [s]	0	10	10	0	10	10	0	10	10	0	10	10
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Recall	Yes	No	No	No	No	No	No	No	No	No	No	No
Maximum Recall	No	No	No	No	No	No	No	No	No	No	No	No
Pedestrian Recall	No	No	No	No	No	No	No	No	No	No	No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	C	R	L	C	R	L	C	R	L	C	R
C, Cycle Length [s]	110	110	110	110	110	110	110	110	110	110	110	110
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	51	39	39	51	41	41	12	35	35	8	32	32
g / C, Green / Cycle	0.47	0.36	0.36	0.47	0.38	0.38	0.11	0.32	0.32	0.08	0.29	0.29
(v / s)_i Volume / Saturation Flow Rate	0.20	0.07	0.11	0.04	0.07	0.32	0.09	0.14	0.10	0.06	0.26	0.04
s, saturation flow rate [veh/h]	818	1399	1277	1146	2974	1334	1482	2897	1314	2825	2877	1273
c, Capacity [veh/h]	491	500	456	532	1117	501	160	926	420	218	832	368
d1, Uniform Delay [s]	21.41	24.44	25.46	20.32	22.96	31.56	48.29	29.64	28.37	49.69	37.64	28.94
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.76	0.88	1.68	0.07	0.34	16.56	12.21	0.33	0.43	4.61	3.93	0.16
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.33	0.20	0.30	0.09	0.17	0.85	0.86	0.44	0.32	0.73	0.90	0.13
d, Delay for Lane Group [s/veh]	23.17	25.32	27.14	20.40	23.29	48.13	60.50	29.97	28.80	54.29	41.57	29.10
Lane Group LOS	C	C	C	C	C	D	E	C	C	D	D	C
Critical Lane Group	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh/ln]	2.85	1.89	2.78	0.78	1.73	12.47	4.23	4.29	2.72	2.27	10.02	0.98
50th-Percentile Queue Length [ft/ln]	71.15	47.14	69.56	19.61	43.30	311.77	105.64	107.15	68.12	56.85	250.54	24.45
95th-Percentile Queue Length [veh/ln]	5.12	3.39	5.01	1.41	3.12	18.26	7.60	7.68	4.90	4.09	15.21	1.76
95th-Percentile Queue Length [ft/ln]	128.07	84.86	125.21	35.30	77.93	456.56	189.91	192.03	122.62	102.33	380.33	44.00

Movement, Approach, & Intersection Results

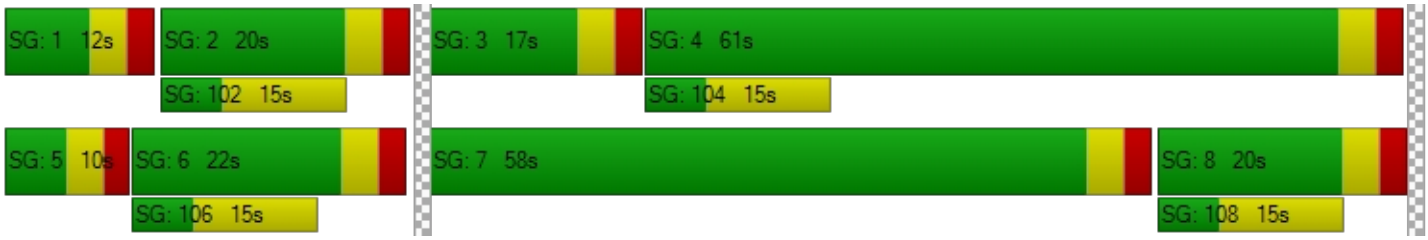
d_M, Delay for Movement [s/veh]	23.17	25.32	27.14	20.40	23.29	48.13	60.50	29.97	28.80	54.29	41.57	29.10
Movement LOS	C	C	C	C	C	D	E	C	C	D	D	C
d_A, Approach Delay [s/veh]	25.08			38.94			35.91			43.04		
Approach LOS	C			D			D			D		
d_I, Intersection Delay [s/veh]	37.61											
Intersection LOS	D											
Intersection V/C	0.894											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	46.37	46.37	46.37	46.37
l_p,int, Pedestrian LOS Score for Intersection	2.483	2.619	3.019	2.934
Crosswalk LOS	B	B	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	273	309	273	1018
d_b, Bicycle Delay [s]	41.02	39.31	41.02	13.25
l_b,int, Bicycle LOS Score for Intersection	1.885	2.112	2.119	2.350
Bicycle LOS	A	B	B	B

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 3: 10th Ave S and 6th St SW/Fox Farm Rd

Control Type:	Signalized	Delay (sec / veh):	49.7
Analysis Method:	HCM 6th Edition	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.984

Intersection Setup

Name											
Approach	Northbound			Southbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	1	2	0	1
Pocket Length [ft]	150.00	100.00	100.00	500.00	100.00	300.00	300.00	100.00	300.00	525.00	100.00	500.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	177	307	348	75	175	246	508	959	232	222	679	92
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.56	1.30	1.15	4.00	0.57	0.00	0.20	2.61	2.16	1.35	3.53	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	177	307	348	75	175	246	508	959	232	222	679	92
Peak Hour Factor	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620	0.9620
Other Adjustment Factor	0.8670	0.8670	0.8670	0.8750	0.8750	0.8750	0.8890	0.8890	0.8890	0.8750	0.8750	0.8750
Total 15-Minute Volume [veh/h]	40	69	78	17	40	56	117	222	54	50	154	21
Total Analysis Volume [veh/h]	160	277	314	68	159	224	469	886	214	202	618	84
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	135
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap
Signal group	5	2	2	1	6	6	3	8	8	7	4	4
Auxiliary Signal Groups			2			6			8			4
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	15	5	15	15	5	15	15
Maximum Green [s]	15	60	60	20	60	60	20	60	60	20	60	60
Amber [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All red [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Split [s]	10	37	37	11	38	38	67	63	63	24	20	20
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Walk [s]	0	5	5	0	5	5	0	5	5	0	5	5
Pedestrian Clearance [s]	0	10	10	0	10	10	0	10	10	0	10	10
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Recall	Yes	No	No	No	No	No	No	No	No	No	No	No
Maximum Recall	No	No	No	No	No	No	No	No	No	No	No	No
Pedestrian Recall	No	No	No	No	No	No	No	No	No	No	No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	C	R	L	C	R	L	C	R	L	C	R
C, Cycle Length [s]	135	135	135	135	135	135	135	135	135	135	135	135
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	45	34	34	45	35	35	44	63	63	12	31	31
g / C, Green / Cycle	0.33	0.25	0.25	0.33	0.26	0.26	0.33	0.47	0.47	0.09	0.23	0.23
(v / s)_i Volume / Saturation Flow Rate	0.22	0.18	0.24	0.07	0.05	0.17	0.31	0.30	0.16	0.07	0.21	0.06
s, saturation flow rate [veh/h]	827	1419	1327	976	2985	1339	1498	2937	1316	2882	2915	1339
c, Capacity [veh/h]	366	356	333	216	771	346	492	1382	619	248	664	305
d1, Uniform Delay [s]	40.40	46.34	49.63	37.54	39.22	44.60	44.27	27.10	22.60	60.64	51.10	42.96
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.23	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	4.57	12.28	36.84	0.82	0.61	9.05	17.96	0.50	0.33	6.41	6.54	0.48
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.49	0.73	0.94	0.31	0.21	0.65	0.95	0.64	0.35	0.81	0.93	0.28
d, Delay for Lane Group [s/veh]	44.97	58.62	86.47	38.37	39.83	53.65	62.24	27.61	22.93	67.05	57.64	43.44
Lane Group LOS	D	E	F	D	D	D	E	C	C	E	E	D
Critical Lane Group	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh/ln]	3.61	9.20	13.77	1.75	2.16	7.57	17.67	10.87	4.40	3.63	10.83	2.38
50th-Percentile Queue Length [ft/ln]	90.33	229.99	344.34	43.79	53.94	189.36	441.74	271.68	109.90	90.75	270.86	59.49
95th-Percentile Queue Length [veh/ln]	6.50	14.17	19.86	3.15	3.88	12.09	24.56	16.27	7.83	6.53	16.23	4.28
95th-Percentile Queue Length [ft/ln]	162.60	354.35	496.50	78.82	97.10	302.20	614.08	406.83	195.87	163.35	405.82	107.08

Movement, Approach, & Intersection Results

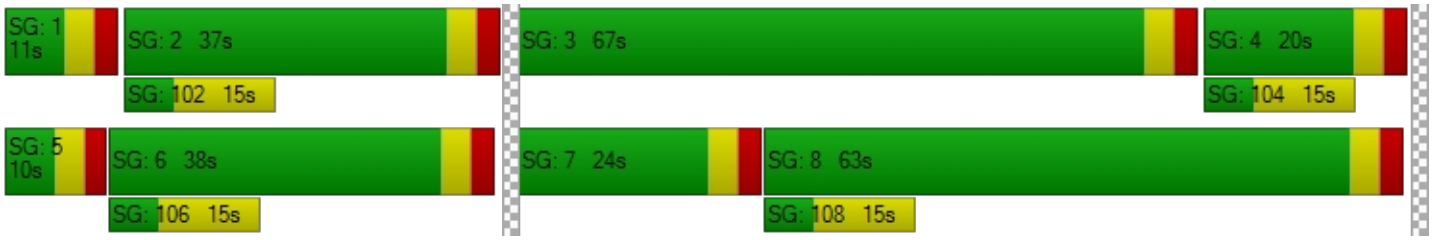
d_M, Delay for Movement [s/veh]	44.97	57.74	86.47	38.37	39.83	53.65	62.24	27.61	22.93	67.05	57.64	43.44
Movement LOS	D	E	F	D	D	D	E	C	C	E	E	D
d_A, Approach Delay [s/veh]	67.03			46.47			37.32			58.42		
Approach LOS	E			D			D			E		
d_I, Intersection Delay [s/veh]	49.71											
Intersection LOS	D											
Intersection V/C	0.984											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	58.80	58.80	58.80	58.80
l_p,int, Pedestrian LOS Score for Intersection	2.579	2.682	3.145	2.999
Crosswalk LOS	B	B	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	474	489	859	222
d_b, Bicycle Delay [s]	39.29	38.53	21.96	53.33
l_b,int, Bicycle LOS Score for Intersection	2.179	1.932	2.854	2.305
Bicycle LOS	B	A	C	B

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#11: Vaughn Rd and I-15 SB

Control Type:	Two-way stop	Delay (sec / veh):	10.1
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.260

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	219	1	0	27	12	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.60	0.00	2.00	11.10	8.30	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	219	1	0	27	12	0
Peak Hour Factor	0.8830	0.2500	1.0000	0.8440	0.7500	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	62	1	0	8	4	0
Total Analysis Volume [veh/h]	248	4	0	32	16	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.26	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.11	9.71	0.00	0.00	0.00	0.00
Movement LOS	B	A		A	A	
95th-Percentile Queue Length [veh]	1.06	1.06	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	26.50	26.50	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.10		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	8.49					
Intersection LOS	B					

Intersection Level Of Service Report
#11: Vaughn Rd and I-15 SB

Control Type:	Two-way stop	Delay (sec / veh):	10.1
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.177

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	143	1	0	53	50	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	7.00	0.00	2.00	7.60	4.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	143	1	0	53	50	0
Peak Hour Factor	0.9410	0.2500	1.0000	0.7790	0.8930	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	38	1	0	17	14	0
Total Analysis Volume [veh/h]	152	4	0	68	56	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.18	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.11	9.46	0.00	0.00	0.00	0.00
Movement LOS	B	A		A	A	
95th-Percentile Queue Length [veh]	0.66	0.66	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	16.44	16.44	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.09		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	5.62					
Intersection LOS	B					

Intersection Level Of Service Report
#12: Vaughn Rd and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	7.3
Analysis Method:	HCM2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.000

Intersection Setup

Name						
Approach	Eastbound		Westbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	237	19	76	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	5.00	5.30	14.50	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	237	19	76	0	0
Peak Hour Factor	1.0000	0.8590	0.5940	0.8260	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	69	8	23	0	0
Total Analysis Volume [veh/h]	0	276	32	92	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Free	Free	Stop
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	7.26	0.00	0.00	0.00	0.00	0.00
Movement LOS	A	A	A	A		
95th-Percentile Queue Length [veh]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		0.00		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
#12: Vaughn Rd and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	7.3
Analysis Method:	HCM2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.000

Intersection Setup

Name						
Approach	Eastbound		Westbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	165	55	334	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	6.10	1.80	4.80	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	165	55	334	0	0
Peak Hour Factor	1.0000	0.7500	0.8090	0.9180	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	55	17	91	0	0
Total Analysis Volume [veh/h]	0	220	68	364	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Free	Free	Stop
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	7.33	0.00	0.00	0.00	0.00	0.00
Movement LOS	A	A	A	A		
95th-Percentile Queue Length [veh]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		0.00		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
#8: Central Ave and I15 SB

Control Type:	Two-way stop	Delay (sec / veh):	28.0
Analysis Method:	HCM2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.499

Intersection Setup

Name												
Approach	Southbound			Eastbound			Westbound			Northwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	130	0	6	0	191	39	123	88	0	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.30	0.00	0.00	2.00	3.10	0.00	6.50	11.30	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	130	0	6	0	191	39	123	88	0	0	0	0
Peak Hour Factor	0.8550	1.0000	0.7500	1.0000	0.6920	0.7500	0.7690	0.8150	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	38	0	2	0	69	13	40	27	0	0	0	0
Total Analysis Volume [veh/h]	152	0	8	0	276	52	160	108	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.50	0.00	0.01	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	28.03	27.54	8.82	0.00	0.00	0.00	8.27	0.00	0.00	0.00	0.00	0.00
Movement LOS	D	D	A		A	A	A	A				
95th-Percentile Queue Length [veh]	2.63	2.63	0.03	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	65.65	65.65	0.64	0.00	0.00	0.00	10.86	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	27.07			0.00			4.94			0.00		
Approach LOS	D			A			A			A		
d_I, Intersection Delay [s/veh]	7.48											
Intersection LOS	D											

Intersection Level Of Service Report
#8: Central Ave and I15 SB

Control Type:	Two-way stop	Delay (sec / veh):	42.0
Analysis Method:	HCM2010	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.432

Intersection Setup

Name												
Approach	Southbound			Eastbound			Westbound			Northwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	66	0	6	0	166	30	230	299	0	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	6.00	0.00	0.00	2.00	0.60	0.00	6.50	1.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	66	0	6	0	166	30	230	299	0	0	0	0
Peak Hour Factor	0.9170	1.0000	0.7500	1.0000	0.8470	0.8330	0.8980	0.8690	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	18	0	2	0	49	9	64	86	0	0	0	0
Total Analysis Volume [veh/h]	72	0	8	0	196	36	256	344	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.43	0.00	0.01	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	42.03	39.90	10.18	0.00	0.00	0.00	8.29	0.00	0.00	0.00	0.00	0.00
Movement LOS	E	E	B		A	A	A	A				
95th-Percentile Queue Length [veh]	1.96	1.96	0.03	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	48.88	48.88	0.86	0.00	0.00	0.00	17.46	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	38.84			0.00			3.54			0.00		
Approach LOS	E			A			A			A		
d_I, Intersection Delay [s/veh]	5.73											
Intersection LOS	E											

Intersection Level Of Service Report
#9: Central Ave and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	19.9
Analysis Method:	HCM2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.080

Intersection Setup

Name											
Approach	Northbound			Eastbound			Westbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	15	0	177	6	305	0	0	202	44	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	10.80	16.70	2.00	2.00	2.00	11.40	13.60	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	15	0	177	6	305	0	0	202	44	0	0	0
Peak Hour Factor	0.5360	1.0000	0.8510	0.7500	0.7190	1.0000	1.0000	0.8420	0.7330	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	7	0	52	2	106	0	0	60	15	0	0	0
Total Analysis Volume [veh/h]	28	0	208	8	424	0	0	240	60	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.08	0.00	0.34	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	19.87	19.21	15.45	7.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Movement LOS	C	C	C	A	A			A	A			
95th-Percentile Queue Length [veh]	2.07	2.07	2.07	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	51.73	51.73	51.73	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	15.98			0.15			0.00			0.00		
Approach LOS	C			A			A			A		
d_I, Intersection Delay [s/veh]	3.96											
Intersection LOS	C											

Intersection Level Of Service Report
#9: Central Ave and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	29.1
Analysis Method:	HCM2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.303

Intersection Setup

Name												
Approach	Northbound			Eastbound			Westbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	57	0	170	5	249	0	0	471	113	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.80	0.00	7.00	0.00	2.00	2.00	2.00	4.60	0.90	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	57	0	170	5	249	0	0	471	113	0	0	0
Peak Hour Factor	0.7130	1.0000	0.7590	0.4170	0.8650	1.0000	1.0000	0.9350	0.8310	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	20	0	56	3	72	0	0	126	34	0	0	0
Total Analysis Volume [veh/h]	80	0	224	12	288	0	0	504	136	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.30	0.00	0.30	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	29.07	27.04	20.30	8.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Movement LOS	D	D	C	A	A			A	A			
95th-Percentile Queue Length [veh]	3.98	3.98	3.98	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	99.39	99.39	99.39	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	22.61			0.34			0.00			0.00		
Approach LOS	C			A			A			A		
d_I, Intersection Delay [s/veh]	5.61											
Intersection LOS	D											

Intersection Level Of Service Report
#10: Central Ave and Vaughn Rd

Control Type:	Two-way stop	Delay (sec / veh):	27.1
Analysis Method:	HCM2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.377

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	77	60	71	410	184	65
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	9.10	6.70	7.00	5.10	11.40	6.20
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	77	60	71	410	184	65
Peak Hour Factor	0.7700	0.7890	0.8450	0.8010	0.8520	0.7740
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	25	19	21	128	54	21
Total Analysis Volume [veh/h]	100	76	84	512	216	84
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.38	0.10	0.07	0.01	0.00	0.00
d_M, Delay for Movement [s/veh]	27.07	18.19	8.13	0.00	0.00	0.00
Movement LOS	D	C	A	A	A	A
95th-Percentile Queue Length [veh]	2.47	2.47	0.22	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	61.70	61.70	5.47	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	23.23		1.15		0.00	
Approach LOS	C		A		A	
d_I, Intersection Delay [s/veh]	4.45					
Intersection LOS	D					

Intersection Level Of Service Report
#10: Central Ave and Vaughn Rd

Control Type:	Two-way stop	Delay (sec / veh):	65.0
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.576

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	68	121	66	361	462	76
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.90	1.60	1.50	4.00	3.40	2.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	68	121	66	361	462	76
Peak Hour Factor	0.6540	0.9450	0.7500	0.7910	0.8680	0.7310
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	26	32	22	114	133	26
Total Analysis Volume [veh/h]	104	128	88	456	532	104
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.58	0.25	0.09	0.00	0.01	0.00
d_M, Delay for Movement [s/veh]	65.02	52.12	9.18	0.00	0.00	0.00
Movement LOS	F	F	A	A	A	A
95th-Percentile Queue Length [veh]	6.75	6.75	0.31	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	168.80	168.80	7.64	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	57.91		1.48		0.00	
Approach LOS	F		A		A	
d_I, Intersection Delay [s/veh]	10.09					
Intersection LOS	F					

Intersection Level Of Service Report
#6: 14th St SW and I-315 WB

Control Type:	Signalized	Delay (sec / veh):	23.0
Analysis Method:	HCM2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.254

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	11	17	90	26	136	0	0	7	15	162	16	38
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	9.10	0.00	4.40	7.70	1.50	0.00	0.00	0.00	0.00	2.50	0.00	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	11	17	90	26	136	0	0	7	15	162	16	38
Peak Hour Factor	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	5	28	8	42	0	0	2	5	50	5	12
Total Analysis Volume [veh/h]	14	21	112	32	169	0	0	9	19	201	20	47
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	yes
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	1	2	0	1	0	0	3	0	0	2	0
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	5	0	5	0	0	5	0	0	5	0
Maximum Green [s]	0	35	40	0	35	0	0	25	0	0	40	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	25	19	0	25	0	0	16	0	0	19	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	9	7	0	9	0	0	0	0	0	7	0
Pedestrian Clearance [s]	0	11	7	0	11	0	0	0	0	0	7	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		no	no		no			no			no	
Maximum Recall		no	no		no			no			no	
Pedestrian Recall		no	no		no			no			no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	C	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	11	11	27	11	11	2	11	11
g / C, Green / Cycle	0.19	0.19	0.45	0.19	0.19	0.03	0.18	0.18
(v / s)_i Volume / Saturation Flow Rate	0.01	0.01	0.08	0.03	0.10	0.02	0.14	0.03
s, saturation flow rate [veh/h]	1019	1710	1392	1181	1685	1527	1636	1454
c, Capacity [veh/h]	178	321	624	283	316	48	290	257
d1, Uniform Delay [s]	27.05	20.04	9.94	22.89	22.00	28.67	23.49	20.99
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.19	0.08	0.14	0.17	1.40	10.79	4.15	0.34
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.08	0.07	0.18	0.11	0.53	0.58	0.76	0.18
d, Delay for Lane Group [s/veh]	27.24	20.13	10.07	23.06	23.41	39.47	27.64	21.33
Lane Group LOS	C	C	B	C	C	D	C	C
Critical Lane Group	no	no	no	no	yes	yes	yes	no
50th-Percentile Queue Length [veh]	0.19	0.23	0.79	0.39	2.12	0.52	3.10	0.55
50th-Percentile Queue Length [ft]	4.78	5.84	19.74	9.76	53.01	13.05	77.54	13.75
95th-Percentile Queue Length [veh]	0.34	0.42	1.42	0.70	3.82	0.94	5.58	0.99
95th-Percentile Queue Length [ft]	8.60	10.51	35.54	17.57	95.41	23.49	139.58	24.76

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	27.24	20.13	10.07	23.06	23.41	23.41	39.47	39.47	39.47	27.64	27.64	21.33
Movement LOS	C	C	B	C	C	C	D	D	D	C	C	C
d_A, Approach Delay [s/veh]	13.14			23.35			39.47			26.53		
Approach LOS	B			C			D			C		
d_I, Intersection Delay [s/veh]	23.05											
Intersection LOS	C											
Intersection V/C	0.254											

Sequence

Ring 1	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#6: 14th St SW and I-315 WB

Control Type:	Signalized	Delay (sec / veh):	19.4
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.536

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	5	76	146	22	131	2	3	5	19	638	12	142
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	40.00	6.60	0.70	0.00	2.30	0.00	0.00	0.00	15.80	1.80	8.30	4.20
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	5	76	146	22	131	2	3	5	19	638	12	142
Peak Hour Factor	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	19	37	6	33	1	1	1	5	161	3	36
Total Analysis Volume [veh/h]	5	77	148	22	133	2	3	5	19	646	12	144
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	yes
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	1	2	0	1	0	0	3	0	0	2	0
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	5	0	5	0	0	5	0	0	5	0
Maximum Green [s]	0	35	40	0	35	0	0	25	0	0	40	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	25	19	0	25	0	0	16	0	0	19	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	9	7	0	9	0	0	0	0	0	7	0
Pedestrian Clearance [s]	0	11	7	0	11	0	0	0	0	0	7	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		no	no		no			no			no	
Maximum Recall		no	no		no			no			no	
Pedestrian Recall		no	no		no			no			no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	C	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	10	10	44	10	10	2	29	29
g / C, Green / Cycle	0.17	0.17	0.73	0.17	0.17	0.03	0.48	0.48
(v / s)_i Volume / Saturation Flow Rate	0.01	0.05	0.10	0.02	0.08	0.02	0.44	0.10
s, saturation flow rate [veh/h]	819	1604	1443	1209	1667	1514	1505	1395
c, Capacity [veh/h]	164	265	1050	223	275	46	721	668
d1, Uniform Delay [s]	27.03	21.97	2.49	25.56	22.75	28.72	14.48	9.09
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.19	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.07	0.60	0.06	0.19	1.35	11.38	8.39	0.16
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.03	0.29	0.14	0.10	0.49	0.59	0.91	0.22
d, Delay for Lane Group [s/veh]	27.10	22.57	2.55	25.75	24.11	40.09	22.87	9.25
Lane Group LOS	C	C	A	C	C	D	C	A
Critical Lane Group	no	no	no	no	yes	yes	yes	no
50th-Percentile Queue Length [veh]	0.07	0.94	0.29	0.29	1.72	0.51	8.46	0.96
50th-Percentile Queue Length [ft]	1.71	23.40	7.27	7.21	43.07	12.75	211.56	24.03
95th-Percentile Queue Length [veh]	0.12	1.68	0.52	0.52	3.10	0.92	13.23	1.73
95th-Percentile Queue Length [ft]	3.07	42.12	13.09	12.99	77.53	22.96	330.84	43.26

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	27.10	22.57	2.55	25.75	24.11	24.11	40.09	40.09	40.09	22.87	22.87	9.25
Movement LOS	C	C	A	C	C	C	D	D	D	C	C	A
d_A, Approach Delay [s/veh]	9.78			24.34			40.09			20.42		
Approach LOS	A			C			D			C		
d_I, Intersection Delay [s/veh]	19.35											
Intersection LOS	B											
Intersection V/C	0.536											

Sequence

Ring 1	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#5: 14th St SW and I-315 EB

Control Type:	Signalized	Delay (sec / veh):	14.4
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.175

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	7	66	286	142	91	60	44	69	3	20	30	5
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	14.30	1.50	1.70	3.50	4.40	5.00	0.00	4.30	0.00	10.00	3.30	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	7	66	286	142	91	60	44	69	3	20	30	5
Peak Hour Factor	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	20	86	43	27	18	13	21	1	6	9	2
Total Analysis Volume [veh/h]	8	80	345	171	110	72	53	83	4	24	36	6
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	no
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal Group	0	2	3	0	6	7	7	4	0	3	8	0
Lead / Lag	-	-	-	-	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	0	5	15	0	5	15	15	5	0	15	15	0
Maximum Green [s]	0	50	20	0	50	20	20	60	0	20	60	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	22	18	0	22	18	18	20	0	18	20	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	5	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	10	10	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	1.0	0.0	3.0	1.0	1.0	3.0	0.0	1.0	3.0	0.0
Minimum Recall		no	no		no	no	no	no		no	no	
Maximum Recall		no	no		no	no	no	no		no	no	
Pedestrian Recall		no	no		no	no	no	no		no	no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	3.00	5.00	5.00	3.00	5.00	5.00	5.00	4.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	0.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	15	15	34	15	15	33	28	12	12	28	10	10
g / C, Green / Cycle	0.24	0.24	0.57	0.24	0.24	0.54	0.47	0.20	0.20	0.47	0.17	0.17
(v / s)_i Volume / Saturation Flow Rate	0.01	0.04	0.22	0.13	0.06	0.05	0.03	0.05	0.00	0.02	0.02	0.00
s, saturation flow rate [veh/h]	1140	1872	1588	1294	1820	1538	1631	1822	1615	1432	1839	1615
c, Capacity [veh/h]	299	452	912	342	439	836	920	360	319	797	307	270
d1, Uniform Delay [s]	21.49	18.04	6.95	23.72	18.38	6.55	8.80	20.24	19.36	8.71	21.23	20.89
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.04	0.19	0.26	1.13	0.30	0.04	0.03	0.32	0.02	0.02	0.17	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

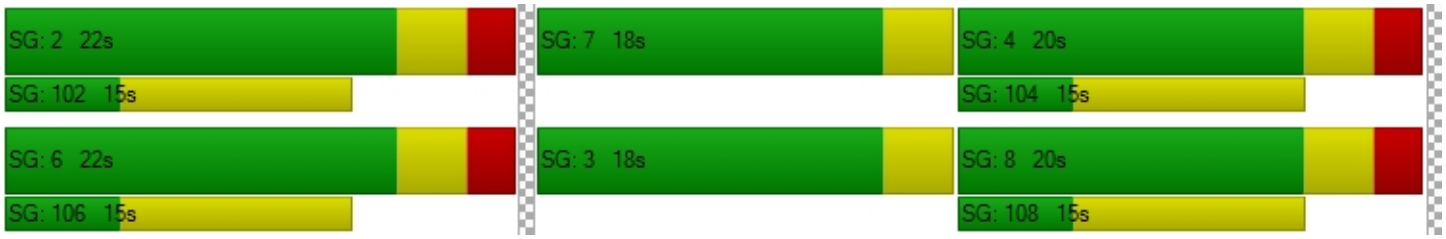
X, volume / capacity	0.03	0.18	0.38	0.50	0.25	0.09	0.06	0.23	0.01	0.03	0.12	0.02
d, Delay for Lane Group [s/veh]	21.52	18.22	7.21	24.85	18.67	6.60	8.83	20.56	19.38	8.72	21.39	20.92
Lane Group LOS	C	B	A	C	B	A	A	C	B	A	C	C
Critical Lane Group	no	no	yes	no	no	no	no	no	no	no	yes	no
50th-Percentile Queue Length [veh]	0.09	0.84	1.92	2.26	1.18	0.37	0.33	0.94	0.04	0.15	0.42	0.07
50th-Percentile Queue Length [ft]	2.32	20.94	47.91	56.41	29.43	9.15	8.37	23.62	1.09	3.74	10.46	1.72
95th-Percentile Queue Length [veh]	0.17	1.51	3.45	4.06	2.12	0.66	0.60	1.70	0.08	0.27	0.75	0.12
95th-Percentile Queue Length [ft]	4.18	37.70	86.24	101.54	52.97	16.46	15.06	42.51	1.95	6.74	18.82	3.09

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	21.52	18.22	7.21	24.85	18.67	6.60	8.83	20.56	19.38	8.72	21.39	20.92
Movement LOS	C	B	A	C	B	A	A	C	B	A	C	C
d_A, Approach Delay [s/veh]	9.51			19.20			16.09			16.74		
Approach LOS	A			B			B			B		
d_I, Intersection Delay [s/veh]	14.37											
Intersection LOS	B											
Intersection V/C	0.175											

Sequence

Ring 1	2	7	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#5: 14th St SW and I-315 EB

Control Type:	Signalized	Delay (sec / veh):	13.0
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.368

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	13	82	260	95	396	262	107	168	10	102	50	31
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.40	1.20	4.30	1.30	0.40	0.90	0.00	0.00	1.00	0.00	12.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	13	82	260	95	396	262	107	168	10	102	50	31
Peak Hour Factor	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	22	69	25	106	70	29	45	3	27	13	8
Total Analysis Volume [veh/h]	14	87	277	101	422	279	114	179	11	109	53	33
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	no
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal Group	0	2	3	0	6	7	7	4	0	3	8	0
Lead / Lag	-	-	-	-	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	0	5	15	0	5	15	15	5	0	15	15	0
Maximum Green [s]	0	50	20	0	50	20	20	45	0	20	45	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	22	18	0	22	18	18	20	0	18	20	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	5	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	10	10	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	1.0	0.0	3.0	1.0	1.0	3.0	0.0	1.0	3.0	0.0
Minimum Recall		no	no		no	no	no	no		no	no	
Maximum Recall		no	no		no	no	no	no		no	no	
Pedestrian Recall		no	no		no	no	no	no		no	no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	3.00	5.00	5.00	3.00	3.00	5.00	5.00	4.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	0.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	18	18	38	18	18	38	32	14	14	32	14	14
g / C, Green / Cycle	0.31	0.31	0.64	0.31	0.31	0.64	0.54	0.24	0.24	0.54	0.24	0.24
(v / s)_i Volume / Saturation Flow Rate	0.01	0.05	0.17	0.08	0.22	0.17	0.07	0.09	0.01	0.07	0.03	0.02
s, saturation flow rate [veh/h]	980	1855	1596	1276	1876	1609	1573	1900	1615	1497	1900	1430
c, Capacity [veh/h]	181	566	1018	416	572	1027	1004	459	390	897	459	345
d1, Uniform Delay [s]	26.77	15.19	4.75	19.22	18.69	4.75	6.76	19.06	17.38	6.92	17.75	17.67
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.18	0.12	0.14	0.30	1.88	0.14	0.05	0.54	0.03	0.06	0.11	0.12
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

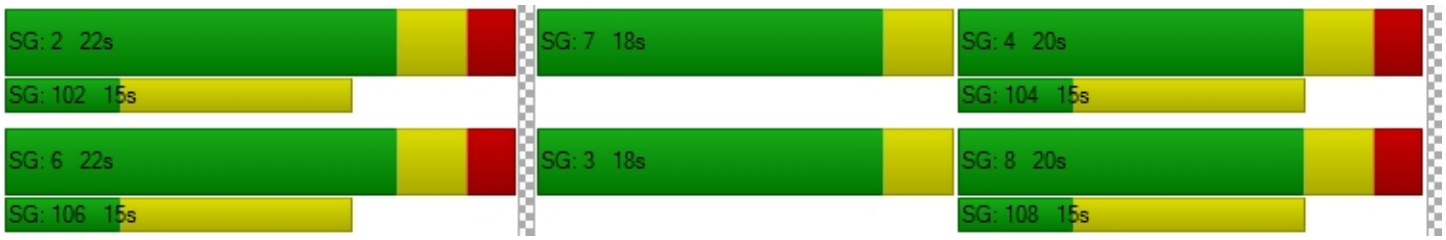
X, volume / capacity	0.08	0.15	0.27	0.24	0.74	0.27	0.11	0.39	0.03	0.12	0.12	0.10
d, Delay for Lane Group [s/veh]	26.95	15.32	4.89	19.52	20.56	4.89	6.81	19.60	17.41	6.98	17.86	17.79
Lane Group LOS	C	B	A	B	C	A	A	B	B	A	B	B
Critical Lane Group	no	no	no	no	yes	yes	no	yes	no	no	no	no
50th-Percentile Queue Length [veh]	0.19	0.81	1.09	1.12	5.03	1.10	0.59	2.00	0.11	0.57	0.55	0.34
50th-Percentile Queue Length [ft]	4.75	20.31	27.29	28.03	125.69	27.47	14.87	49.98	2.78	14.22	13.67	8.53
95th-Percentile Queue Length [veh]	0.34	1.46	1.96	2.02	8.70	1.98	1.07	3.60	0.20	1.02	0.98	0.61
95th-Percentile Queue Length [ft]	8.55	36.56	49.12	50.46	217.62	49.44	26.77	89.97	5.01	25.60	24.60	15.36

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.95	15.32	4.89	19.52	20.56	4.89	6.81	19.60	17.41	6.98	17.86	17.79
Movement LOS	C	B	A	B	C	A	A	B	B	A	B	B
d_A, Approach Delay [s/veh]	8.11			14.98			14.72			11.77		
Approach LOS	A			B			B			B		
d_I, Intersection Delay [s/veh]	13.01											
Intersection LOS	B											
Intersection V/C	0.368											

Sequence

Ring 1	2	7	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#4: I-15 SB Off and Airport RD Frontage

Control Type:	Two-way stop	Delay (sec / veh):	12.7
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.272

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	5	0	44	159	54	96	8	12	0	0	40	4
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	11.30	10.10	7.40	3.10	12.50	8.30	2.00	2.00	2.50	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	5	0	44	159	54	96	8	12	0	0	40	4
Peak Hour Factor	0.4170	1.0000	0.5240	0.8110	0.9000	0.7060	0.4000	0.7500	1.0000	1.0000	0.7690	0.5000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	0	21	49	15	34	5	4	0	0	13	2
Total Analysis Volume [veh/h]	12	0	84	196	60	136	20	16	0	0	52	8
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no	no		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.02	0.00	0.09	0.27	0.08	0.13	0.01	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.78	0.00	9.10	12.67	12.44	8.90	7.47	0.00	0.00	0.00	0.00	0.00
Movement LOS	B		A	B	B	A	A	A			A	A
95th-Percentile Queue Length [veh]	0.34	0.00	0.34	1.59	1.59	0.44	0.07	0.07	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	8.59	0.00	8.59	39.68	39.68	11.00	1.87	1.87	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	9.31			11.33			4.15			0.00		
Approach LOS	A			B			A			A		
d_I, Intersection Delay [s/veh]	9.39											
Intersection LOS	B											

Intersection Level Of Service Report
#4: I-15 SB Off and Airport RD Frontage

Control Type:	Two-way stop	Delay (sec / veh):	35.3
Analysis Method:	HCM2010	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.660

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	0	0	55	217	26	47	8	15	0	0	286	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	1.80	18.90	11.50	2.10	37.50	6.70	2.00	2.00	1.00	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	55	217	26	47	8	15	0	0	286	1
Peak Hour Factor	1.0000	1.0000	0.7240	0.8350	0.7220	0.6910	0.6670	0.7500	1.0000	1.0000	0.6810	0.2500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	19	65	9	17	3	5	0	0	105	1
Total Analysis Volume [veh/h]	0	0	76	260	36	68	12	20	0	0	420	4
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no	no		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.12	0.66	0.08	0.06	0.01	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	14.08	0.00	11.47	35.33	33.80	8.64	8.76	0.00	0.00	0.00	0.00	0.00
Movement LOS	B		B	E	D	A	A	A			A	A
95th-Percentile Queue Length [veh]	0.41	0.00	0.41	5.82	5.82	0.21	0.10	0.10	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	10.19	0.00	10.19	145.42	145.42	5.15	2.56	2.56	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	11.47			30.19			3.29			0.00		
Approach LOS	B			D			A			A		
d_I, Intersection Delay [s/veh]	13.35											
Intersection LOS	E											

Intersection Level Of Service Report
#3: I-15 SB On and Airport RD

Control Type:	Two-way stop	Delay (sec / veh):	8.6
Analysis Method:	HCM2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.046

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	0	32	23	251	6
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	43.80	21.70	14.00	16.70
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	32	23	251	6
Peak Hour Factor	1.0000	1.0000	0.6670	0.6390	0.8720	0.3750
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	12	9	72	4
Total Analysis Volume [veh/h]	0	0	48	36	288	16
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.05	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	8.58	0.00	0.00	0.00
Movement LOS			A	A	A	A
95th-Percentile Queue Length [veh]	0.00	0.00	0.26	0.26	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	6.49	6.49	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		4.90		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	1.06					
Intersection LOS	A					

Intersection Level Of Service Report
#3: I-15 SB On and Airport RD

Control Type:	Two-way stop	Delay (sec / veh):	11.0
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.063

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	0	25	21	542	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	64.00	19.10	7.30	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	25	21	542	14
Peak Hour Factor	1.0000	1.0000	0.6250	0.7500	0.7450	0.7000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	10	7	182	5
Total Analysis Volume [veh/h]	0	0	40	28	728	20
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop		Free		Free	
Flared Lane						
Storage Area [veh]	0		0		0	
Two-Stage Gap Acceptance						
Number of Storage Spaces in Median	0		0		0	

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.06	0.00	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	11.03	0.00	0.00	0.00
Movement LOS			B	A	A	A
95th-Percentile Queue Length [veh]	0.00	0.00	0.36	0.36	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	8.91	8.91	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		6.49		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.54					
Intersection LOS	B					

Intersection Level Of Service Report
#2: I-15 NB and Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	16.9
Analysis Method:	HCM2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.000

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	4	0	13	0	0	0	0	49	222	79	173	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	46.20	2.00	2.00	2.00	2.00	38.80	26.60	12.70	10.90	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	0	13	0	0	0	0	49	222	79	173	0
Peak Hour Factor	0.5000	1.0000	0.8130	1.0000	1.0000	1.0000	1.0000	0.7210	0.8670	0.7050	0.9010	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	0	4	0	0	0	0	17	64	28	48	0
Total Analysis Volume [veh/h]	8	0	16	0	0	0	0	68	256	112	192	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop			Stop			Free			Free		
Flared Lane	no											
Storage Area [veh]	0			0			0			0		
Two-Stage Gap Acceptance	no											
Number of Storage Spaces in Median	0			0			0			0		

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00
d_M, Delay for Movement [s/veh]	14.89	16.91	10.09	0.00	0.00	0.00	0.00	0.00	0.00	8.38	0.00	0.00
Movement LOS	B	C	B					A	A	A	A	
95th-Percentile Queue Length [veh]	0.13	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.03	1.03	0.00
95th-Percentile Queue Length [ft]	3.34	3.34	3.34	0.00	0.00	0.00	0.00	0.00	0.00	25.85	25.85	0.00
d_A, Approach Delay [s/veh]	11.69			0.00			0.00			3.09		
Approach LOS	B			A			A			A		
d_I, Intersection Delay [s/veh]	1.87											
Intersection LOS	C											

Intersection Level Of Service Report
#2: I-15 NB and Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	55.4
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.053

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	2	2	31	0	0	0	0	47	197	307	236	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	47.40	2.00	2.00	2.00	2.00	40.40	20.80	0.70	17.40	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2	2	31	0	0	0	0	47	197	307	236	0
Peak Hour Factor	0.5000	0.5000	0.7750	1.0000	1.0000	1.0000	1.0000	0.6910	0.8210	0.6910	0.8680	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	10	0	0	0	0	17	60	111	68	0
Total Analysis Volume [veh/h]	4	4	40	0	0	0	0	68	240	444	272	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.05	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00
d_M, Delay for Movement [s/veh]	48.66	55.37	12.63	0.00	0.00	0.00	0.00	0.00	0.00	9.40	0.00	0.00
Movement LOS	E	F	B					A	A	A	A	
95th-Percentile Queue Length [veh]	0.56	0.56	0.56	0.00	0.00	0.00	0.00	0.00	0.00	3.74	3.74	0.00
95th-Percentile Queue Length [ft]	13.96	13.96	13.96	0.00	0.00	0.00	0.00	0.00	0.00	93.56	93.56	0.00
d_A, Approach Delay [s/veh]	19.19			0.00			0.00			5.83		
Approach LOS	C			A			A			A		
d_I, Intersection Delay [s/veh]	4.75											
Intersection LOS	F											

Intersection Level Of Service Report
#1: Tri Hill and Frontage Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	13.5
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.202

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	83	19	9	189	97	88
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	21.70	31.10	22.20	28.60	25.70	5.70
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	83	19	9	189	97	88
Peak Hour Factor	0.7410	0.4750	0.5630	0.8750	0.9330	0.7590
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	28	10	4	54	26	29
Total Analysis Volume [veh/h]	112	40	16	216	104	116
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.20	0.05	0.01	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	13.48	11.42	7.94	0.00	0.00	0.00
Movement LOS	B	B	A	A	A	A
95th-Percentile Queue Length [veh]	0.99	0.99	0.04	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	24.73	24.73	0.98	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	12.93		0.55		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	3.47					
Intersection LOS	B					

Intersection Level Of Service Report
#1: Tri Hill and Frontage Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	14.5
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.256

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	75	7	9	160	207	70
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.70	0.00	22.20	33.80	18.90	15.80
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	75	7	9	160	207	70
Peak Hour Factor	0.5680	0.4380	0.7500	0.8000	0.8480	0.8330
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	33	4	3	50	61	21
Total Analysis Volume [veh/h]	132	16	12	200	244	84
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.26	0.02	0.01	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	14.52	12.30	8.23	0.00	0.00	0.00
Movement LOS	B	B	A	A	A	A
95th-Percentile Queue Length [veh]	1.12	1.12	0.03	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	28.04	28.04	0.81	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	14.28		0.47		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	3.22					
Intersection LOS	B					

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	324	79	11	132	201	66	223	43	362	179	15
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1776	1776	1776	1776	1776	1776	1900	1900	1776	1900
Adj Flow Rate, veh/h	18	405	99	14	165	251	82	279	54	452	224	19
Adj No. of Lanes	1	1	1	1	1	1	1	2	0	0	2	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	7	7	7	7	7	7	7	7	7	7	7	7
Cap, veh/h	343	537	457	210	531	826	244	408	78	419	400	34
Arrive On Green	0.02	0.30	0.30	0.01	0.30	0.30	0.14	0.14	0.14	0.25	0.25	0.25
Sat Flow, veh/h	1691	1776	1509	1691	1776	1509	1691	2828	540	1691	1615	137
Grp Volume(v), veh/h	18	405	99	14	165	251	82	165	168	452	0	243
Grp Sat Flow(s),veh/h/ln	1691	1776	1509	1691	1776	1509	1691	1687	1680	1691	0	1752
Q Serve(g_s), s	0.5	14.1	3.4	0.4	4.9	6.2	3.0	6.4	6.5	17.0	0.0	8.3
Cycle Q Clear(g_c), s	0.5	14.1	3.4	0.4	4.9	6.2	3.0	6.4	6.5	17.0	0.0	8.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.32	1.00		0.08
Lane Grp Cap(c), veh/h	343	537	457	210	531	826	244	243	242	419	0	434
V/C Ratio(X)	0.05	0.75	0.22	0.07	0.31	0.30	0.34	0.68	0.69	1.08	0.00	0.56
Avail Cap(c_a), veh/h	426	945	804	298	945	1178	419	418	417	419	0	434
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.4	21.6	17.8	17.8	18.6	8.4	26.4	27.8	27.9	25.8	0.0	22.5
Incr Delay (d2), s/veh	0.1	2.2	0.2	0.1	0.3	0.2	0.8	3.3	3.6	66.4	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	7.2	1.4	0.2	2.4	4.0	1.4	3.2	3.3	15.5	0.0	4.2
LnGrp Delay(d),s/veh	16.4	23.8	18.1	17.9	18.9	8.6	27.2	31.1	31.5	92.1	0.0	24.1
LnGrp LOS	B	C	B	B	B	A	C	C	C	F		C
Approach Vol, veh/h		522			430			415			695	
Approach Delay, s/veh		22.4			12.9			30.5			68.4	
Approach LOS		C			B			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		14.9	5.9	25.7		22.0	6.2	25.5
Change Period (Y+Rc), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s		17.0	4.5	36.5		17.0	4.5	36.5
Max Q Clear Time (g_c+I1), s		8.5	2.4	16.1		19.0	2.5	8.2
Green Ext Time (p_c), s		1.4	0.0	4.6		0.0	0.0	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	37.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	19	326	92	39	313	403	149	435	53	338	206	25
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1900	1900	1845	1900
Adj Flow Rate, veh/h	21	362	102	43	348	448	166	483	59	376	229	28
Adj No. of Lanes	1	1	1	1	1	1	1	2	0	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	221	532	452	255	555	824	337	603	73	394	362	44
Arrive On Green	0.02	0.29	0.29	0.03	0.30	0.30	0.19	0.19	0.19	0.22	0.22	0.22
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	3147	383	1757	1613	197
Grp Volume(v), veh/h	21	362	102	43	348	448	166	268	274	376	0	257
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1752	1777	1757	0	1810
Q Serve(g_s), s	0.6	13.2	3.8	1.3	12.3	14.4	6.4	11.1	11.2	16.0	0.0	9.7
Cycle Q Clear(g_c), s	0.6	13.2	3.8	1.3	12.3	14.4	6.4	11.1	11.2	16.0	0.0	9.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.22	1.00		0.11
Lane Grp Cap(c), veh/h	221	532	452	255	555	824	337	336	341	394	0	406
V/C Ratio(X)	0.09	0.68	0.23	0.17	0.63	0.54	0.49	0.80	0.80	0.95	0.00	0.63
Avail Cap(c_a), veh/h	292	889	756	304	889	1108	394	393	399	394	0	406
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.3	23.9	20.5	19.2	22.8	11.9	27.3	29.2	29.2	29.0	0.0	26.5
Incr Delay (d2), s/veh	0.2	1.5	0.3	0.3	1.2	0.6	1.1	9.6	9.9	33.4	0.0	3.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	6.9	1.6	0.6	6.5	9.2	3.2	6.3	6.4	11.4	0.0	5.2
LnGrp Delay(d),s/veh	19.5	25.4	20.8	19.5	24.0	12.5	28.4	38.8	39.1	62.4	0.0	29.7
LnGrp LOS	B	C	C	B	C	B	C	D	D	E		C
Approach Vol, veh/h		485			839			708			633	
Approach Delay, s/veh		24.2			17.6			36.5			49.1	
Approach LOS		C			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		19.5	7.4	26.8		22.0	6.4	27.8
Change Period (Y+Rc), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s		17.0	4.5	36.5		17.0	4.5	36.5
Max Q Clear Time (g_c+I1), s		13.2	3.3	15.2		18.0	2.6	16.4
Green Ext Time (p_c), s		1.4	0.0	6.5		0.0	0.0	6.4

Intersection Summary	
HCM 2010 Ctrl Delay	31.3
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	477	254	26	364	84	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	250	150	-	0	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	7	7	7	7	7	7
Mvmt Flow	568	302	31	433	100	42

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	568	0	1063	568
Stage 1	-	-	-	-	568	-
Stage 2	-	-	-	-	495	-
Critical Hdwy	-	-	4.17	-	6.47	6.27
Critical Hdwy Stg 1	-	-	-	-	5.47	-
Critical Hdwy Stg 2	-	-	-	-	5.47	-
Follow-up Hdwy	-	-	2.263	-	3.563	3.363
Pot Cap-1 Maneuver	-	-	980	-	242	513
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	602	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	980	-	234	513
Mov Cap-2 Maneuver	-	-	-	-	234	-
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	583	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	25.9
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	234	513	-	-	980	-
HCM Lane V/C Ratio	0.427	0.081	-	-	0.032	-
HCM Control Delay (s)	31.4	12.6	-	-	8.8	-
HCM Lane LOS	D	B	-	-	A	-
HCM 95th %tile Q(veh)	2	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	6.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	494	256	54	622	100	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	250	150	-	0	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	568	294	62	715	115	32

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	568	0	1407	568
Stage 1	-	-	-	-	568	-
Stage 2	-	-	-	-	839	-
Critical Hdwy	-	-	4.15	-	6.45	6.25
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	-	-	2.245	-	3.545	3.345
Pot Cap-1 Maneuver	-	-	989	-	151	517
Stage 1	-	-	-	-	561	-
Stage 2	-	-	-	-	419	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	989	-	142	517
Mov Cap-2 Maneuver	-	-	-	-	142	-
Stage 1	-	-	-	-	561	-
Stage 2	-	-	-	-	393	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	75.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	142	517	-	-	989	-
HCM Lane V/C Ratio	0.809	0.062	-	-	0.063	-
HCM Control Delay (s)	92.7	12.4	-	-	8.9	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	5.1	0.2	-	-	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	391	135	8	200	0	184	1	26	0	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1759	1759	1900	1759	1759	1900	1759	1759	1900	1900	1759	1900
Adj Flow Rate, veh/h	2	483	167	10	247	0	227	1	32	0	0	0
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	0	1	0
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	8	8	8	8	8	8	8	8	8	8	8	8
Cap, veh/h	671	647	224	361	911	0	539	9	292	0	352	0
Arrive On Green	0.52	0.52	0.52	0.52	0.52	0.00	0.20	0.20	0.20	0.00	0.00	0.00
Sat Flow, veh/h	1066	1251	432	735	1759	0	1675	46	1457	0	1759	0
Grp Volume(v), veh/h	2	0	650	10	247	0	227	0	33	0	0	0
Grp Sat Flow(s),veh/h/ln	1066	0	1683	735	1759	0	1675	0	1502	0	1759	0
Q Serve(g_s), s	0.0	0.0	10.8	0.4	2.8	0.0	4.4	0.0	0.6	0.0	0.0	0.0
Cycle Q Clear(g_c), s	2.8	0.0	10.8	11.1	2.8	0.0	4.4	0.0	0.6	0.0	0.0	0.0
Prop In Lane	1.00		0.26	1.00		0.00	1.00		0.97	0.00		0.00
Lane Grp Cap(c), veh/h	671	0	871	361	911	0	539	0	301	0	352	0
V/C Ratio(X)	0.00	0.00	0.75	0.03	0.27	0.00	0.42	0.00	0.11	0.00	0.00	0.00
Avail Cap(c_a), veh/h	1021	0	1425	603	1490	0	1149	0	848	0	993	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	5.6	0.0	6.7	11.1	4.8	0.0	13.1	0.0	11.6	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	1.3	0.0	0.2	0.0	0.5	0.0	0.2	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	5.2	0.1	1.3	0.0	2.1	0.0	0.3	0.0	0.0	0.0
LnGrp Delay(d),s/veh	5.6	0.0	8.0	11.1	5.0	0.0	13.6	0.0	11.7	0.0	0.0	0.0
LnGrp LOS	A		A	B	A		B		B			
Approach Vol, veh/h		652			257			260			0	
Approach Delay, s/veh		8.0			5.2			13.4			0.0	
Approach LOS		A			A			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		12.1		23.3		12.1		23.3
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		20.0		30.0		20.0		30.0
Max Q Clear Time (g_c+I1), s		6.4		12.8		0.0		13.1
Green Ext Time (p_c), s		0.7		5.3		0.0		5.2

Intersection Summary	
HCM 2010 Ctrl Delay	8.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	273	227	51	480	1	167	0	21	2	1	2
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1900	1792	1792	1900	1792	1792	1900	1900	1792	1900
Adj Flow Rate, veh/h	0	317	264	59	558	1	194	0	24	2	1	2
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	0	1	0
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	202	467	389	406	923	2	478	0	309	220	110	126
Arrive On Green	0.00	0.52	0.52	0.52	0.52	0.52	0.20	0.00	0.20	0.20	0.20	0.20
Sat Flow, veh/h	815	905	754	799	1789	3	1355	0	1524	385	544	620
Grp Volume(v), veh/h	0	0	581	59	0	559	194	0	24	5	0	0
Grp Sat Flow(s),veh/h/ln	815	0	1659	799	0	1792	1355	0	1524	1549	0	0
Q Serve(g_s), s	0.0	0.0	9.3	2.1	0.0	7.8	4.6	0.0	0.5	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	9.3	11.4	0.0	7.8	4.7	0.0	0.5	0.1	0.0	0.0
Prop In Lane	1.00		0.45	1.00		0.00	1.00		1.00	0.40		0.40
Lane Grp Cap(c), veh/h	202	0	856	406	0	925	478	0	309	456	0	0
V/C Ratio(X)	0.00	0.00	0.68	0.15	0.00	0.60	0.41	0.00	0.08	0.01	0.00	0.00
Avail Cap(c_a), veh/h	309	0	1073	511	0	1159	851	0	728	864	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	6.4	10.6	0.0	6.1	13.2	0.0	11.5	11.3	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	1.2	0.2	0.0	0.6	0.6	0.0	0.1	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	4.5	0.5	0.0	3.9	1.8	0.0	0.2	0.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.0	7.6	10.8	0.0	6.7	13.7	0.0	11.6	11.3	0.0	0.0
LnGrp LOS			A	B		A	B		B	B		
Approach Vol, veh/h		581			618			218			5	
Approach Delay, s/veh		7.6			7.1			13.5			11.3	
Approach LOS		A			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		12.2		23.4		12.2		23.4
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		17.0		23.0		17.0		23.0
Max Q Clear Time (g_c+I1), s		6.7		11.3		2.1		13.4
Green Ext Time (p_c), s		0.5		5.7		0.6		5.0

Intersection Summary	
HCM 2010 Ctrl Delay	8.3
HCM 2010 LOS	A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*36th Ave. NE / Bootlegger Tr.*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *36th Avenue NE* | North/South Street: *Bootlegger Trail*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*236*	*111*	*0*	*0*	*58*	*18*
Peak-Hour Factor, PHF	*0.88*	*0.84*	*0.25*	*0.25*	*0.85*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*268*	*132*	*0*	*0*	*68*	*24*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*33*	*0*	*92*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.64*	*0.25*	*0.92*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*51*	*0*	*99*	*0*	*0*	*0*
Percent Heavy Vehicles	*3*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*268*	*0*		*0*			*150*	
C (m) (veh/h)	*1515*	*1466*					*530*	
v/c	*0.18*	*0.00*					*0.28*	
95% queue length	*0.64*	*0.00*					*1.16*	
Control Delay (s/veh)	*7.9*	*7.5*					*14.5*	
LOS	*A*	*A*					*B*	
Approach Delay (s/veh)	--	--				*14.5*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*36th Ave. NE / Bootlegger Tr.*
Jurisdiction	*Great Falls*
Analysis Year	

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *36th Avenue NE* | North/South Street: *Bootlegger Trail*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*41*	*32*	*0*	*0*	*151*	*12*
Peak-Hour Factor, PHF	*0.64*	*0.80*	*0.25*	*0.25*	*0.79*	*0.60*
Hourly Flow Rate, HFR (veh/h)	*64*	*39*	*0*	*0*	*191*	*19*
Percent Heavy Vehicles	*5*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*13*	*0*	*290*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.81*	*0.25*	*0.76*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*381*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*3*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*64*	*0*		*0*			*397*	
C (m) (veh/h)	*1343*	*1584*					*822*	
v/c	*0.05*	*0.00*					*0.48*	
95% queue length	*0.15*	*0.00*					*2.67*	
Control Delay (s/veh)	*7.8*	*7.3*					*13.4*	
LOS	*A*	*A*					*B*	
Approach Delay (s/veh)	--	--				*13.4*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*Bootlegger Tr. / U.S. 87*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Bootlegger Trail* North/South Street: *U.S. 87*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*106*	*118*	*5*	*0*	*113*	*8*
Peak-Hour Factor, PHF	*0.76*	*0.92*	*0.42*	*0.25*	*0.71*	*0.67*
Hourly Flow Rate, HFR (veh/h)	*139*	*128*	*11*	*0*	*159*	*11*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*	*0*	*435*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.73*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*15*	*0*	*595*	*0*	*0*	*0*
Percent Heavy Vehicles	*10*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*139*	*0*		*0*			*610*	
C (m) (veh/h)	*1420*	*1457*					*946*	
v/c	*0.10*	*0.00*					*0.64*	
95% queue length	*0.32*	*0.00*					*4.88*	
Control Delay (s/veh)	*7.8*	*7.5*					*15.4*	
LOS	*A*	*A*					*C*	
Approach Delay (s/veh)	--	--				*15.4*		
Approach LOS	--	--				*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Bootlegger Tr. / U.S. 87*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Bootlegger Trail* | North/South Street: *U.S. 87*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*391*	*174*	*0*	*0*	*177*	*11*
Peak-Hour Factor, PHF	*0.80*	*0.91*	*0.25*	*0.25*	*0.81*	
Hourly Flow Rate, HFR (veh/h)	*488*	*191*	*0*	*0*	*218*	*11*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*216*	*6*	*0*	*1*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.83*	*0.75*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*7*	*0*	*260*	*8*	*0*	*4*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*488*	*0*		*12*			*267*	
C (m) (veh/h)	*1351*	*1395*		*96*			*750*	
v/c	*0.36*	*0.00*		*0.13*			*0.36*	
95% queue length	*1.67*	*0.00*		*0.41*			*1.62*	
Control Delay (s/veh)	*9.2*	*7.6*		*47.8*			*12.4*	
LOS	*A*	*A*		*E*			*B*	
Approach Delay (s/veh)	--	--	*47.8*			*12.4*		
Approach LOS	--	--	*E*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Trisha Bodlovic*	Intersection	*Old Havre Hwy / 15th St. N*
Agency/Co.	*Robert Peccia & Associates*	Jurisdiction	*Great Falls*
Date Performed	*6/19/2013*	Analysis Year	*2013 - Existing*
Analysis Time Period	*AM Peak Hour*		

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Old Havre Highway* | North/South Street: *15th Street North*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*8*	*135*	*7*	*0*	*379*	*181*
Peak-Hour Factor, PHF	*0.40*	*0.89*	*0.58*	*0.25*	*0.77*	*0.72*
Hourly Flow Rate, HFR (veh/h)	*19*	*151*	*12*	*0*	*492*	*251*
Percent Heavy Vehicles	*13*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*1*
Lanes	*1*	*2*	*0*	*1*	*2*	*1*
Configuration	*L*	*T*	*TR*	*L*	*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*89*	*5*	*8*	*3*	*2*	*1*
Peak-Hour Factor, PHF	*0.86*	*0.63*	*0.50*	*0.38*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*103*	*7*	*16*	*7*	*8*	*4*
Percent Heavy Vehicles	*20*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*19*	*0*		*19*			*126*	
C (m) (veh/h)	*994*	*1428*		*467*			*360*	
v/c	*0.02*	*0.00*		*0.04*			*0.35*	
95% queue length	*0.06*	*0.00*		*0.13*			*1.53*	
Control Delay (s/veh)	*8.7*	*7.5*		*13.0*			*20.3*	
LOS	*A*	*A*		*B*			*C*	
Approach Delay (s/veh)	--	--	*13.0*			*20.3*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/19/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Old Havre Hwy / 15th St. N*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Old Havre Highway* | North/South Street: *15th Street North*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*9*	*323*	*8*	*1*	*181*	*161*
Peak-Hour Factor, PHF	*0.56*	*0.89*	*0.67*	*0.25*	*0.87*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*16*	*362*	*11*	*4*	*208*	*191*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*1*
Lanes	*1*	*2*	*0*	*1*	*2*	*1*
Configuration	*L*	*T*	*TR*	*L*	*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*188*	*4*	*10*	*4*	*5*	*0*
Peak-Hour Factor, PHF	*0.94*	*0.50*	*0.42*	*0.50*	*0.63*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*200*	*8*	*23*	*8*	*7*	*0*
Percent Heavy Vehicles	*8*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*16*	*4*		*15*			*231*	
C (m) (veh/h)	*1375*	*1197*		*414*			*502*	
v/c	*0.01*	*0.00*		*0.04*			*0.46*	
95% queue length	*0.04*	*0.01*		*0.11*			*2.39*	
Control Delay (s/veh)	*7.6*	*8.0*		*14.0*			*18.1*	
LOS	*A*	*A*		*B*			*C*	
Approach Delay (s/veh)	--	--	*14.0*			*18.1*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*25th Ave. NE / 8th St. NE*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *25th Avenue NE* | North/South Street: *8th Street NE*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*167*	*57*	*153*	*270*	*8*
Peak-Hour Factor, PHF	*0.63*	*0.62*	*0.59*	*0.74*	*0.73*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*7*	*269*	*96*	*206*	*369*	*11*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*48*	*9*	*17*	*19*	*62*
Peak-Hour Factor, PHF	*0.50*	*0.92*	*0.56*	*0.53*	*0.53*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*12*	*52*	*16*	*32*	*35*	*87*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*7*	*206*		*154*			*80*	
C (m) (veh/h)	*1182*	*1197*		*234*			*162*	
v/c	*0.01*	*0.17*		*0.66*			*0.49*	
95% queue length	*0.02*	*0.62*		*4.10*			*2.38*	
Control Delay (s/veh)	*8.1*	*8.6*		*45.8*			*47.2*	
LOS	*A*	*A*		*E*			*E*	
Approach Delay (s/veh)	--	--	*45.8*			*47.2*		
Approach LOS	--	--	*E*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*25th Ave. NE / 8th St. NE*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *25th Avenue NE* | North/South Street: *8th Street NE*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*14*	*190*	*28*	*59*	*119*	*3*
Peak-Hour Factor, PHF	*0.50*	*0.78*	*0.88*	*0.87*	*0.83*	*0.38*
Hourly Flow Rate, HFR (veh/h)	*28*	*243*	*31*	*67*	*143*	*7*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*2*	*24*	*17*	*36*	*67*	*175*
Peak-Hour Factor, PHF	*0.25*	*0.75*	*0.53*	*0.75*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*8*	*32*	*32*	*48*	*79*	*208*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*1*	*1*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*28*	*67*		*335*			*72*	
C (m) (veh/h)	*1444*	*1301*		*546*			*448*	
v/c	*0.02*	*0.05*		*0.61*			*0.16*	
95% queue length	*0.06*	*0.16*		*4.12*			*0.57*	
Control Delay (s/veh)	*7.5*	*7.9*		*21.5*			*14.6*	
LOS	*A*	*A*		*C*			*B*	
Approach Delay (s/veh)	--	--	*21.5*			*14.6*		
Approach LOS	--	--	*C*			*B*		

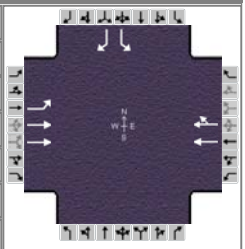
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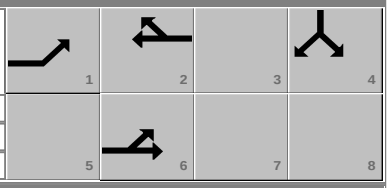
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.83
Intersection	Smelter Ave. / 6th St. NE	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	19_SmelterAve_6thStNE_AM.xus				
Project Description	Great Falls Area LRTP				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	32	744			659	24				144		117

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.4	64.0	16.0	0.0	0.0	0.0
Yellow	3.7	3.9	3.9	0.0	0.0	0.0
Red	0.9	1.1	1.1	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	10.0	79.0		69.0				21.0
Change Period, *(Y+Rc)*, s	4.6	5.0		5.0				5.0
Max Allow Headway *(MAH)*, s	3.1	0.0		0.0				3.2
Queue Clearance Time *(g_s)*, s	2.7							12.1
Green Extension Time *(g_e)*, s	0.0	0.0		0.0				0.3
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							0.57

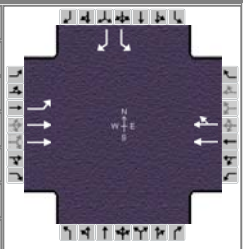
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6			2	12				7		14
Adjusted Flow Rate *(v)*, veh/h	39	896			414	409				173		141
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1556			1635	1611				1619		1441
Queue Service Time *(g_s)*, s	0.7	10.5			12.2	12.2				10.1		9.1
Cycle Queue Clearance Time *(g_c)*, s	0.7	10.5			12.2	12.2				10.1		9.1
Capacity *(c)*, veh/h	509	2303			1046	1031				259		231
Volume-to-Capacity Ratio *(X)*	0.076	0.389			0.396	0.396				0.670		0.612
Available Capacity *(c_a)*, veh/h	509	2303			1046	1031				259		231
Back of Queue *(Q)*, veh/ln (50th percentile)	0.2	2.6			4.0	4.0				4.3		3.3
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0			0.0	0.0				0.0		0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay *(d_1)*, s/veh	5.3	4.7			8.7	8.7				39.5		39.1
Incremental Delay *(d_2)*, s/veh	0.0	0.5			1.1	1.1				5.3		3.4
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay *(d)*, s/veh	5.3	5.2			9.8	9.8				44.9		42.5
Level of Service (LOS)	A	A			A	A				D		D
Approach Delay, s/veh / LOS	5.2	A		9.8	A		0.0			43.8	D	
Intersection Delay, s/veh / LOS	12.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.6	A	2.2	B	2.7	B	2.9	C
Bicycle LOS Score / LOS	1.3	A	1.2	A				F

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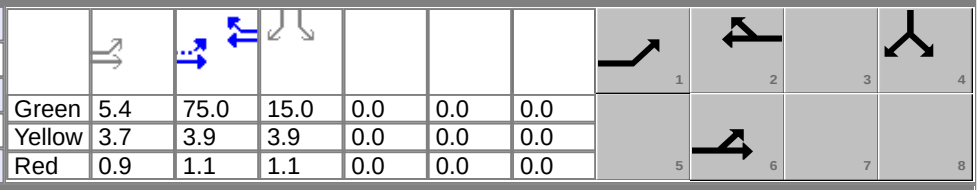
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.97
Intersection	Smelter Ave. / 6th St. NE	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	19_SmelterAve_6thStNE_PM.xus				
Project Description	Great Falls Area LRTP				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	62	840			1057	59				83		84

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.4	75.0	15.0	0.0	0.0	0.0
Yellow	3.7	3.9	3.9	0.0	0.0	0.0
Red	0.9	1.1	1.1	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	10.0	90.0		80.0				20.0
Change Period, *(Y+Rc)*, s	4.6	5.0		5.0				5.0
Max Allow Headway *(MAH)*, s	3.1	0.0		0.0				3.2
Queue Clearance Time *(g_s)*, s	3.1							8.1
Green Extension Time *(g_e)*, s	0.0	0.0		0.0				0.2
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							0.02

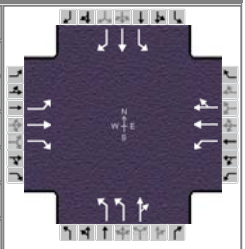
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6			2	12				7		14
Adjusted Flow Rate *(v)*, veh/h	64	866			581	569				86		87
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1602			1667	1631				1619		1441
Queue Service Time *(g_s)*, s	1.1	9.3			18.7	18.8				5.3		6.1
Cycle Queue Clearance Time *(g_c)*, s	1.1	9.3			18.7	18.8				5.3		6.1
Capacity *(c)*, veh/h	399	2476			1136	1112				221		196
Volume-to-Capacity Ratio *(X)*	0.160	0.350			0.512	0.512				0.388		0.441
Available Capacity *(c_a)*, veh/h	399	2476			1136	1112				221		196
Back of Queue *(Q)*, veh/ln (50th percentile)	0.3	2.3			6.2	6.1				2.1		2.2
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0			0.0	0.0				0.0		0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay *(d_1)*, s/veh	5.9	3.9			8.6	8.6				43.3		43.6
Incremental Delay *(d_2)*, s/veh	0.1	0.4			1.6	1.7				0.4		0.6
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay *(d)*, s/veh	5.9	4.3			10.2	10.2				43.7		44.2
Level of Service (LOS)	A	A			B	B				D		D
Approach Delay, s/veh / LOS	4.4	A		10.2	B		0.0			44.0	D	
Intersection Delay, s/veh / LOS	10.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.6	A	2.2	B	2.7	B	2.9	C
Bicycle LOS Score / LOS	1.3	A	1.4	A				F

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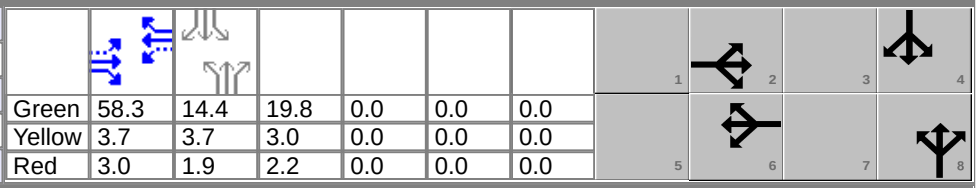
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.82
Intersection	Smelter Ave. / 10th St. NE	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	20_SmelterAve_10thStNE_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	117	112	647	34	156	19	432	81	19	9	145	112

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	58.3	14.4	19.8	0.0	0.0	0.0						
Yellow	3.7	3.7	3.0	0.0	0.0	0.0						
Red	3.0	1.9	2.2	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		5.0		6.0		10.0		9.0
Phase Duration, s		65.0		65.0		25.0		20.0
Change Period, *(Y+Rc)*, s		6.7		6.7		5.2		5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		4.1		4.1
Queue Clearance Time *(g_s)*, s						20.6		13.3
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.1
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

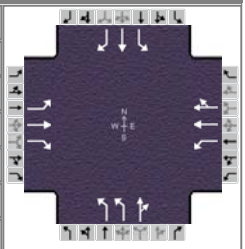
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	143	137	789	41	108	106	527	122		11	177	137
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1079	1650	1396	614	1650	1588	1541	1628		1619	1667	1295
Queue Service Time *(g_s)*, s	8.4	4.7	58.3	4.1	3.6	3.7	18.6	7.3		0.7	11.3	11.3
Cycle Queue Clearance Time *(g_c)*, s	12.1	4.7	58.3	8.7	3.6	3.7	18.6	7.3		0.7	11.3	11.3
Capacity *(c)*, veh/h	601	875	740	365	875	842	555	293		212	218	170
Volume-to-Capacity Ratio *(X)*	0.237	0.156	1.067	0.114	0.123	0.126	0.949	0.416		0.052	0.810	0.806
Available Capacity *(c_a)*, veh/h	601	875	740	365	875	842	555	293		212	218	170
Back of Queue *(Q)*, veh/ln (50th percentile)	2.1	1.7	28.1	0.6	1.3	1.3	8.9	2.9		0.3	5.8	4.7
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	16.1	13.2	25.9	15.5	13.0	13.0	44.6	40.0		41.8	46.5	46.4
Incremental Delay *(d_2)*, s/veh	0.9	0.4	52.4	0.6	0.3	0.3	26.1	0.9		0.1	20.1	24.0
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	17.0	13.6	78.2	16.1	13.3	13.3	70.7	40.9		41.9	66.5	70.5
Level of Service (LOS)	B	B	F	B	B	B	E	D		D	E	E
Approach Delay, s/veh / LOS	61.8	E		13.8	B		65.1	E		67.4	E	
Intersection Delay, s/veh / LOS	58.2						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	2.5	B	2.9	C
Bicycle LOS Score / LOS	2.3	B	0.7	A	1.6	A	1.0	A

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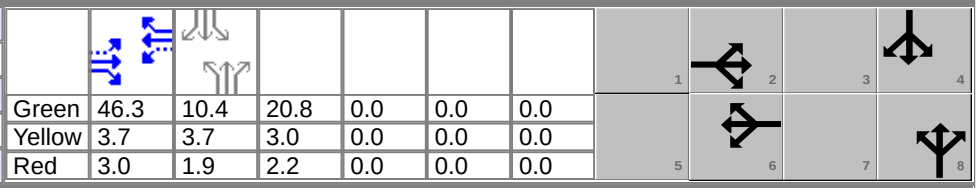
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.95
Intersection	Smelter Ave. / 10th St. NE	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	20_SmelterAve_10thStNE_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	127	163	683	45	306	19	713	144	50	13	114	173

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	46.3	10.4	20.8	0.0	0.0	0.0						
Yellow	3.7	3.7	3.0	0.0	0.0	0.0						
Red	3.0	1.9	2.2	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		5.0		6.0		10.0		9.0
Phase Duration, s		53.0		53.0		26.0		16.0
Change Period, $(Y+R_c)$, s		6.7		6.7		5.2		5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		4.1		4.2
Queue Clearance Time (g_s), s						22.8		12.4
Green Extension Time (g_e), s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

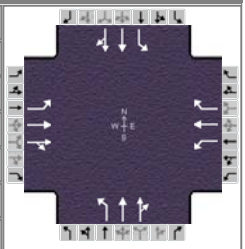
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	134	172	719	47	172	170	751	204		14	120	182
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1034	1683	1397	634	1700	1665	1572	1625		1619	1667	1326
Queue Service Time (g_s), s	8.1	5.5	46.3	4.4	5.5	5.5	20.8	10.7		0.7	6.6	10.4
Cycle Queue Clearance Time (g_c), s	13.6	5.5	46.3	9.9	5.5	5.5	20.8	10.7		0.7	6.6	10.4
Capacity *(c)*, veh/h	519	820	681	348	829	811	688	356		177	182	145
Volume-to-Capacity Ratio *(X)*	0.257	0.209	1.056	0.136	0.208	0.210	1.090	0.574		0.077	0.658	1.255
Available Capacity (c_a), veh/h	519	820	681	348	829	811	688	356		177	182	145
Back of Queue *(Q)*, veh/ln (50th percentile)	2.0	2.1	23.0	0.7	2.1	2.1	13.5	4.3		0.3	3.0	9.7
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh	17.8	13.9	24.4	16.7	13.9	13.9	37.1	33.1		38.0	40.6	42.3
Incremental Delay (d_2), s/veh	1.2	0.6	50.3	0.8	0.6	0.6	61.5	2.2		0.2	8.3	158.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	19.0	14.5	74.6	17.5	14.5	14.5	98.6	35.4		38.2	48.9	201.1
Level of Service (LOS)	B	B	F	B	B	B	F	D		D	D	F
Approach Delay, s/veh / LOS	57.3	E		14.8	B		85.1	F		136.2	F	
Intersection Delay, s/veh / LOS	70.3						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	2.5	B	2.8	C
Bicycle LOS Score / LOS	2.2	B	0.8	A	2.1	B	1.0	A

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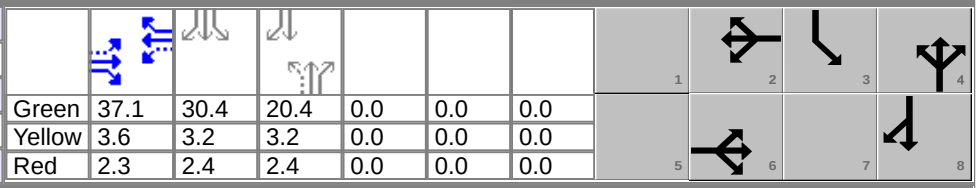
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	River Rd. / 9th St. N	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	RiverRd_9thStN_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	49	197	10	5	78	169	8	179	18	273	277	122

Signal Information			
Cycle, s	105.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.1	30.4	20.4	0.0	0.0	0.0			
Yellow	3.6	3.2	3.2	0.0	0.0	0.0			
Red	2.3	2.4	2.4	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		6		2		4	3	8
Case Number		6.0		5.0		6.3	2.0	4.0
Phase Duration, s		43.0		43.0		26.0	36.0	62.0
Change Period, *(Y+Rc)*, s		5.9		5.9		5.6	5.6	5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		2.1	2.6	2.1
Queue Clearance Time *(g_s)*, s						7.8	18.7	9.7
Green Extension Time *(g_e)*, s		0.0		0.0		0.4	0.3	0.4
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						0.00	0.00	0.00

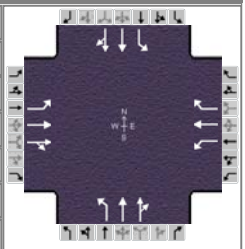
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	53	113	112	5	85	184	9	108	106	297	225	208
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1128	1700	1671	1173	1700	1441	964	1700	1646	1619	1700	1521
Queue Service Time *(g_s)*, s	3.5	4.8	4.9	0.3	3.6	9.9	0.8	5.7	5.8	16.7	7.4	7.7
Cycle Queue Clearance Time *(g_c)*, s	7.1	4.8	4.9	5.2	3.6	9.9	0.8	5.7	5.8	16.7	7.4	7.7
Capacity *(c)*, veh/h	429	601	590	429	601	509	256	330	320	469	913	817
Volume-to-Capacity Ratio *(X)*	0.124	0.188	0.190	0.013	0.141	0.361	0.034	0.326	0.333	0.633	0.247	0.255
Available Capacity *(c_a)*, veh/h	429	601	590	429	601	509	256	330	320	469	913	817
Back of Queue *(Q)*, veh/ln (50th percentile)	1.0	2.0	2.0	0.1	1.5	3.6	0.2	2.4	2.3	6.7	2.7	2.5
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	25.5	23.5	23.5	25.3	23.1	25.2	34.4	36.4	36.4	32.4	13.0	13.0
Incremental Delay *(d_2)*, s/veh	0.6	0.7	0.7	0.1	0.5	2.0	0.0	0.2	0.2	2.1	0.1	0.1
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	26.1	24.2	24.2	25.4	23.6	27.1	34.4	36.6	36.7	34.6	13.0	13.1
Level of Service (LOS)	C	C	C	C	C	C	C	D	D	C	B	B
Approach Delay, s/veh / LOS	24.6	C		26.0	C		36.5	D		21.8	C	
Intersection Delay, s/veh / LOS	25.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.4	B
Bicycle LOS Score / LOS	0.7	A	0.9	A	0.7	A	1.1	A

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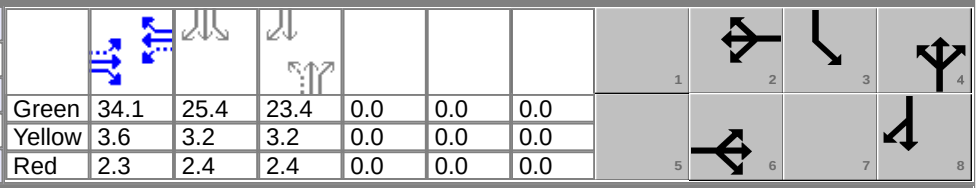
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	River Rd. / 9th St. N	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	RiverRd_9thStN_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	102	137	8	37	231	278	14	437	29	282	381	118

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	34.1	25.4	23.4	0.0	0.0	0.0			
Yellow	3.6	3.2	3.2	0.0	0.0	0.0			
Red	2.3	2.4	2.4	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		6		2		4	3	8
Case Number		6.0		5.0		6.3	2.0	4.0
Phase Duration, s		40.0		40.0		29.0	31.0	60.0
Change Period, *(Y+Rc)*, s		5.9		5.9		5.6	5.6	5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		2.1	2.6	2.1
Queue Clearance Time (g_s), s						16.0	20.1	11.2
Green Extension Time (g_e), s		0.0		0.0		0.6	0.2	0.7
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						0.04	0.07	0.00

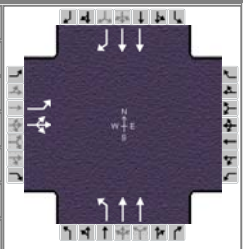
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	111	79	79	40	251	302	15	255	251	307	280	262
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	869	1518	1488	1124	1604	1385	877	1667	1629	1572	1700	1562
Queue Service Time (g_s), s	11.4	3.6	3.7	2.6	12.2	18.4	1.4	13.9	14.0	18.1	9.0	9.2
Cycle Queue Clearance Time (g_c), s	23.7	3.6	3.7	6.3	12.2	18.4	1.4	13.9	14.0	18.1	9.0	9.2
Capacity *(c)*, veh/h	262	518	507	414	547	472	277	390	381	399	925	850
Volume-to-Capacity Ratio *(X)*	0.423	0.153	0.155	0.097	0.459	0.640	0.055	0.655	0.658	0.768	0.303	0.308
Available Capacity (c_a), veh/h	262	518	507	414	547	472	277	390	381	399	925	850
Back of Queue *(Q)*, veh/ln (50th percentile)	2.7	1.4	1.4	0.7	4.9	6.7	0.3	5.8	5.7	7.6	3.2	3.0
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	35.0	22.9	22.9	25.1	25.7	27.8	29.9	34.6	34.7	34.6	12.5	12.5
Incremental Delay (d_2), s/veh	4.9	0.6	0.6	0.5	2.8	6.5	0.0	3.1	3.3	7.9	0.1	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	39.9	23.5	23.6	25.6	28.5	34.3	29.9	37.8	38.0	42.5	12.5	12.6
Level of Service (LOS)	D	C	C	C	C	C	C	D	D	D	B	B
Approach Delay, s/veh / LOS	30.3	C		31.2	C		37.7	D		23.4	C	
Intersection Delay, s/veh / LOS	29.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.4	B
Bicycle LOS Score / LOS	0.7	A	1.5	A	0.9	A	1.2	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.87
Intersection	NW Bypass / 3rd St. NW	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	NWBypass_3rdStNW_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	156	0	59				84	222			230	210

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4		
Green	8.1	60.2	23.0	0.0	0.0	0.0	5	6	7	8		
Yellow	3.9	3.9	3.6	0.0	0.0	0.0						
Red	2.0	2.9	2.4	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			1	6		2
Case Number		10.0			1.0	4.0		7.3
Phase Duration, s		29.0			14.0	81.0		67.0
Change Period, ($Y+R_c$), s		6.0			5.9	6.8		6.8
Max Allow Headway (*MAH*), s		4.7			4.1	0.0		0.0
Queue Clearance Time (g_s), s		12.8			4.5			
Green Extension Time (g_e), s		0.8			0.1	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		0.06			1.00			

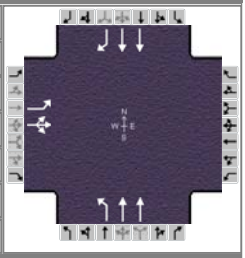
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				1	6			2	12
Adjusted Flow Rate (*v*), veh/h	179	179					97	255			264	241
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1619	1619					1619	1618			1618	1441
Queue Service Time (g_s), s	10.8	10.8					2.5	3.1			4.4	10.0
Cycle Queue Clearance Time (g_c), s	10.8	10.8					2.5	3.1			4.4	10.0
Capacity (*c*), veh/h	339	339					645	2183			1771	788
Volume-to-Capacity Ratio (*X*)	0.530	0.530					0.150	0.117			0.149	0.306
Available Capacity (c_a), veh/h	339	339					645	2183			1771	788
Back of Queue (*Q*), veh/ln (50th percentile)	4.4	4.4					0.8	1.0			1.6	3.3
Overflow Queue (Q_3), veh/ln	0.0	0.0					0.0	0.0			0.0	0.0
Queue Storage Ratio (*RQ*) (50th percentile)	0.00	0.00					0.00	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	38.7	38.7					7.8	6.3			12.3	13.5
Incremental Delay (d_2), s/veh	1.8	1.8					0.1	0.1			0.2	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0					0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	40.5	40.5					7.9	6.4			12.5	14.5
Level of Service (LOS)	D	D					A	A			B	B
Approach Delay, s/veh / LOS	39.4	D		0.0			6.8	A		13.5	B	
Intersection Delay, s/veh / LOS	17.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	1.9	A	2.3	B
Bicycle LOS Score / LOS	0.9	A			0.8	A	0.9	A

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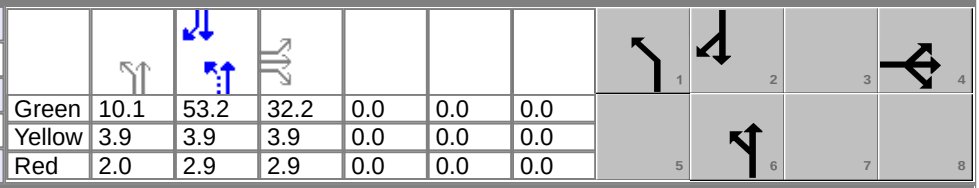
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	NW Bypass / 3rd St. NW	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	NWBypass_3rdStNW_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	362	0	145				222	572			486	507

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.1	53.2	32.2	0.0	0.0	0.0			
Yellow	3.9	3.9	3.9	0.0	0.0	0.0			
Red	2.0	2.9	2.9	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			1	6		2
Case Number		10.0			1.0	4.0		7.3
Phase Duration, s		39.0			16.0	76.0		60.0
Change Period, *(Y+Rc)*, s		6.8			5.9	6.8		6.8
Max Allow Headway *(MAH)*, s		4.7			4.1	0.0		0.0
Queue Clearance Time *(g_s)*, s		29.6			10.7			
Green Extension Time *(g_e)*, s		0.7			0.0	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

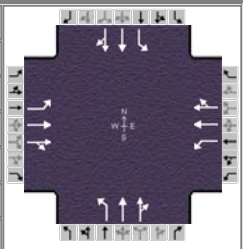
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				1	6			2	12
Adjusted Flow Rate *(v)*, veh/h	393	393					241	622			528	551
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1572	1572					1619	1587			1571	1412
Queue Service Time *(g_s)*, s	27.6	27.6					8.7	11.2			12.5	39.5
Cycle Queue Clearance Time *(g_c)*, s	27.6	27.6					8.7	11.2			12.5	39.5
Capacity *(c)*, veh/h	440	440					393	1910			1454	653
Volume-to-Capacity Ratio *(X)*	0.894	0.894					0.614	0.326			0.363	0.843
Available Capacity *(c_a)*, veh/h	440	440					393	1910			1454	653
Back of Queue *(Q)*, veh/ln (50th percentile)	12.9	12.9					3.3	3.8			4.6	15.0
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0					0.0	0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00					0.00	0.00			0.00	0.00
Uniform Delay *(d_1)*, s/veh	39.8	39.8					14.3	11.3			20.0	27.2
Incremental Delay *(d_2)*, s/veh	20.4	20.4					2.8	0.5			0.7	12.6
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0					0.0	0.0			0.0	0.0
Control Delay *(d)*, s/veh	60.1	60.1					17.1	11.8			20.7	39.8
Level of Service (LOS)	E	E					B	B			C	D
Approach Delay, s/veh / LOS	52.7	D		0.0			13.3	B		30.4	C	
Intersection Delay, s/veh / LOS	29.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	1.9	A	2.3	B
Bicycle LOS Score / LOS	1.4	A			1.2	A	1.4	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 12, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	Central Ave. NW / 6th St. N	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	CentralAveNW_6thStNW_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	32	530	63	113	229	40	63	270	68	87	172	19

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.0	40.5	4.0	1.0	19.5	0.0	1	2	3	4	5	6	7	8
Yellow	3.0	3.2	3.0	0.0	3.2	0.0								
Red	2.0	2.3	2.0	0.0	2.3	0.0								

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2	7	4	3	8
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	46.0	9.0	46.0	9.0	25.0	10.0	26.0
Change Period, *(Y+Rc)*, s	5.0	5.5	5.0	5.5	5.0	5.5	5.0	5.5
Max Allow Headway *(MAH)*, s	3.6	0.0	3.6	0.0	3.6	3.6	3.6	3.6
Queue Clearance Time *(g_s)*, s	3.0		5.9		5.0	11.1	6.0	6.8
Green Extension Time *(g_e)*, s	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.3
Phase Call Probability	1.00		1.00		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		1.00	0.12	1.00	0.01

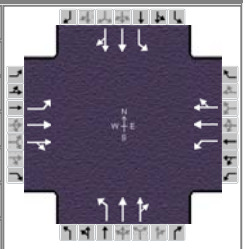
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	35	328	317	123	148	144	68	188	179	95	105	103
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1572	1635	1573	1557	1491	1414	1587	1683	1562	1619	1650	1592
Queue Service Time *(g_s)*, s	1.0	12.4	12.5	3.9	5.5	5.6	3.0	8.9	9.1	4.0	4.7	4.8
Cycle Queue Clearance Time *(g_c)*, s	1.0	12.4	12.5	3.9	5.5	5.6	3.0	8.9	9.1	4.0	4.7	4.8
Capacity *(c)*, veh/h	565	736	708	388	671	637	354	365	338	288	376	363
Volume-to-Capacity Ratio *(X)*	0.062	0.446	0.448	0.317	0.221	0.227	0.193	0.515	0.530	0.328	0.278	0.284
Available Capacity *(c_a)*, veh/h	565	736	708	388	671	637	354	365	338	288	376	363
Back of Queue *(Q)*, veh/ln (50th percentile)	0.3	4.8	4.6	1.3	1.9	1.9	1.1	3.6	3.5	1.5	1.8	1.8
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	11.9	17.0	17.0	13.5	15.1	15.2	25.8	31.1	31.2	25.2	28.6	28.7
Incremental Delay *(d_2)*, s/veh	0.0	2.0	2.0	0.3	0.8	0.8	0.2	1.0	1.3	0.5	0.3	0.3
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	12.0	19.0	19.1	13.9	15.9	16.0	26.0	32.1	32.5	25.7	28.9	29.0
Level of Service (LOS)	B	B	B	B	B	B	C	C	C	C	C	C
Approach Delay, s/veh / LOS	18.7	B		15.3	B		31.3	C		27.9	C	
Intersection Delay, s/veh / LOS	22.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.0	A	0.8	A	0.8	A	0.7	A

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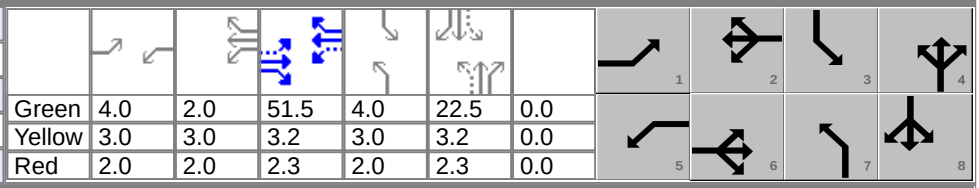
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 12, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	Central Ave. NW / 6th St. N	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	CentralAveNW_6thStNW_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	31	386	78	332	542	123	71	259	72	112	296	24

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.0	2.0	51.5	4.0	22.5	0.0
Yellow	3.0	3.0	3.2	3.0	3.2	0.0
Red	2.0	2.0	2.3	2.0	2.3	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2	7	4	3	8
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	57.0	16.0	64.0	9.0	28.0	9.0	28.0
Change Period, ($Y+R_c$), s	5.0	5.5	5.0	5.5	5.0	5.5	5.0	5.5
Max Allow Headway (*MAH*), s	3.6	0.0	3.6	0.0	3.6	3.6	3.6	3.6
Queue Clearance Time (g_s), s	3.2		13.0		6.0	13.1	6.0	12.3
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.5
Phase Call Probability	1.00		1.00		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		1.00	0.11	1.00	0.08

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate (*v*), veh/h	34	258	246	361	373	350	77	184	176	122	175	172
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1527	1650	1553	1587	1650	1543	1603	1683	1556	1603	1683	1633
Queue Service Time (g_s), s	1.2	10.8	11.0	11.0	15.0	15.1	4.0	10.8	11.1	4.0	10.2	10.3
Cycle Queue Clearance Time (g_c), s	1.2	10.8	11.0	11.0	15.0	15.1	4.0	10.8	11.1	4.0	10.2	10.3
Capacity (*c*), veh/h	397	773	727	552	878	821	239	344	318	230	344	334
Volume-to-Capacity Ratio (*X*)	0.085	0.334	0.339	0.654	0.425	0.427	0.323	0.535	0.552	0.529	0.510	0.516
Available Capacity (c_a), veh/h	397	773	727	552	878	821	239	344	318	230	344	334
Back of Queue (*Q*), veh/ln (50th percentile)	0.4	4.3	4.1	3.9	5.8	5.4	1.7	4.5	4.3	1.5	4.2	4.2
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (*RQ*) (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	14.1	18.4	18.5	12.1	15.6	15.6	34.3	39.1	39.2	39.2	38.9	38.9
Incremental Delay (d_2), s/veh	0.1	1.2	1.3	2.5	1.5	1.6	0.6	1.3	1.7	1.8	1.0	1.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	14.2	19.6	19.8	14.7	17.1	17.2	34.8	40.4	40.9	41.0	39.8	40.0
Level of Service (LOS)	B	B	B	B	B	B	C	D	D	D	D	D
Approach Delay, s/veh / LOS	19.3	B		16.3	B		39.6	D		40.2	D	
Intersection Delay, s/veh / LOS	25.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.8	C
Bicycle LOS Score / LOS	0.9	A	1.4	A	0.8	A	0.9	A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*6th St. SW / 4th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *4th Avenue SW* North/South Street: *6th Street SW*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*227*	*292*	*2*	*316*	*2*
Peak-Hour Factor, PHF	*0.38*	*0.86*	*0.73*	*0.50*	*0.83*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*7*	*263*	*399*	*4*	*380*	*4*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*1*	*7*	*41*	*1*	*4*
Peak-Hour Factor, PHF	*0.25*	*0.25*	*0.88*	*0.60*	*0.25*	*0.33*
Hourly Flow Rate, HFR (veh/h)	*4*	*4*	*7*	*68*	*4*	*12*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*7*	*4*		*84*			*15*	
C (m) (veh/h)	*1186*	*936*		*358*			*419*	
v/c	*0.01*	*0.00*		*0.23*			*0.04*	
95% queue length	*0.02*	*0.01*		*0.90*			*0.11*	
Control Delay (s/veh)	*8.1*	*8.9*		*18.1*			*13.9*	
LOS	*A*	*A*		*C*			*B*	
Approach Delay (s/veh)	--	--	*18.1*			*13.9*		
Approach LOS	--	--	*C*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*6th St. SW / 4th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *4th Avenue SW* North/South Street: *6th Street SW*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*443*	*137*	*4*	*726*	*9*
Peak-Hour Factor, PHF	*0.83*	*0.89*	*0.75*	*0.50*	*0.89*	*0.56*
Hourly Flow Rate, HFR (veh/h)	*12*	*497*	*182*	*8*	*815*	*16*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*2*	*14*	*70*	*1*	*4*
Peak-Hour Factor, PHF	*0.25*	*0.50*	*0.70*	*0.76*	*0.25*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*4*	*4*	*20*	*92*	*4*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

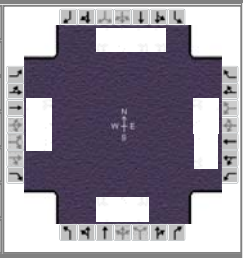
Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*12*	*8*		*104*			*28*	
C (m) (veh/h)	*808*	*923*		*182*			*303*	
v/c	*0.01*	*0.01*		*0.57*			*0.09*	
95% queue length	*0.05*	*0.03*		*3.05*			*0.30*	
Control Delay (s/veh)	*9.5*	*8.9*		*48.3*			*18.1*	
LOS	*A*	*A*		*E*			*C*	
Approach Delay (s/veh)	--	--	*48.3*			*18.1*		
Approach LOS	--	--	*E*			*C*		

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 29, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.77
Intersection	Central Ave. W / 3rd St. NW	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	16_CentralAveW_3rdStNW_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	84	649	1	41	362	201	2	129	156	400	24	76

Signal Information			
Cycle, s	82.4	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4	
Green	3.3	11.3	9.2	16.6	14.9	0.0	5	6	7	8	
Yellow	3.0	3.2	3.0	3.9	3.6	0.0					
Red	2.0	2.3	2.0	1.6	2.4	0.0					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4	3	8
Case Number	2.0	4.0	2.0	3.0		5.3	2.0	3.0
Phase Duration, s	14.2	31.1	8.3	25.2		20.9	22.1	43.0
Change Period, $(Y+R_c)$, s	5.5	5.5	5.0	5.5		6.0	5.5	6.0
Max Allow Headway *(MAH)*, s	4.1	4.1	3.2	4.2		4.3	4.2	4.3
Queue Clearance Time (g_s), s	7.7	22.0	4.7	16.3		13.1	15.2	6.0
Green Extension Time (g_e), s	0.0	3.5	0.0	3.4		0.3	1.4	1.7
Phase Call Probability	0.92	1.00	0.70	1.00		1.00	1.00	1.00
Max Out Probability	1.00	0.00	1.00	0.00		1.00	0.35	0.02

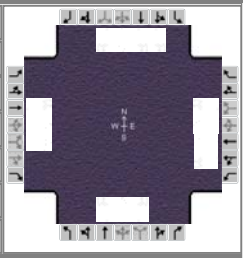
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	109	422	422	53	470	261	3	168	203	519	31	99
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1513	1619	1618	1619	1513	1410	1266	1667	1436	1557	1700	1225
Queue Service Time (g_s), s	5.7	20.0	20.0	2.7	11.5	14.3	0.1	7.5	11.1	13.2	0.8	4.0
Cycle Queue Clearance Time (g_c), s	5.7	20.0	20.0	2.7	11.5	14.3	0.1	7.5	11.1	13.2	0.8	4.0
Capacity *(c)*, veh/h	161	503	503	65	722	337	316	301	259	626	763	549
Volume-to-Capacity Ratio *(X)*	0.678	0.839	0.839	0.815	0.651	0.776	0.008	0.556	0.781	0.829	0.041	0.180
Available Capacity (c_a), veh/h	161	1375	1374	138	1835	855	318	303	261	831	763	549
Back of Queue *(Q)*, veh/ln (50th percentile)	2.6	7.9	7.9	1.2	4.1	2.9	0.0	3.1	4.7	5.3	0.3	1.1
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	35.5	26.5	26.5	39.2	28.3	11.6	27.7	30.8	32.2	31.6	12.8	13.6
Incremental Delay (d_2), s/veh	10.9	3.8	3.8	8.8	1.0	3.8	0.0	2.2	14.0	5.4	0.0	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	46.4	30.3	30.3	48.1	29.3	15.5	27.7	33.0	46.2	36.9	12.8	13.8
Level of Service (LOS)	D	C	C	D	C	B	C	C	D	D	B	B
Approach Delay, s/veh / LOS	32.1	C		26.0	C		40.1	D		32.3	C	
Intersection Delay, s/veh / LOS	31.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	3.0	C	2.8	C
Bicycle LOS Score / LOS	1.3	A	1.1	A	1.1	A	1.6	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 29, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	Central Ave. W / 3rd St. NW	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	16_CentralAveW_3rdStNW_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	138	506	3	82	876	571	4	107	65	408	54	157

Signal Information			
Cycle, s	136.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	9.3	51.5	16.0	21.6	11.0	0.0	5	6	7	8
Yellow	3.0	3.2	3.0	3.9	3.6	0.0				
Red	2.0	2.3	2.0	1.6	2.4	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4	3	8
Case Number	2.0	4.0	2.0	3.0		5.3	2.0	3.0
Phase Duration, s	21.0	78.0	14.3	71.3		17.0	27.1	44.1
Change Period, *(Y+Rc)*, s	5.5	5.5	5.0	5.5		6.0	5.5	6.0
Max Allow Headway *(MAH)*, s	4.1	4.1	3.2	4.2		4.4	4.2	4.4
Queue Clearance Time *(g_s)*, s	14.9	15.0	9.5	55.5		11.2	20.9	15.7
Green Extension Time *(g_e)*, s	0.5	2.6	0.0	10.1		0.0	0.6	1.6
Phase Call Probability	1.00	1.00	0.97	1.00		1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.17	0.00		1.00	1.00	0.00

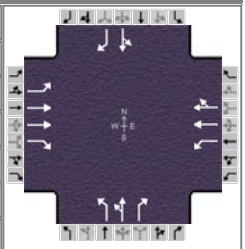
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	150	277	276	89	952	621	4	116	71	443	59	171
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1557	1635	1631	1603	1602	1441	763	1700	1419	1572	1700	1396
Queue Service Time *(g_s)*, s	12.9	13.0	13.0	7.5	29.9	53.5	0.7	9.2	6.6	18.9	3.5	13.7
Cycle Queue Clearance Time *(g_c)*, s	12.9	13.0	13.0	7.5	29.9	53.5	0.7	9.2	6.6	18.9	3.5	13.7
Capacity *(c)*, veh/h	177	870	868	109	1548	696	114	137	114	498	475	390
Volume-to-Capacity Ratio *(X)*	0.849	0.318	0.318	0.818	0.615	0.892	0.038	0.850	0.618	0.891	0.124	0.438
Available Capacity *(c_a)*, veh/h	467	870	868	164	3589	1613	114	137	114	552	475	390
Back of Queue *(Q)*, veh/ln (50th percentile)	5.6	5.0	5.0	3.4	11.4	12.4	0.1	5.4	2.7	8.6	1.5	4.8
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	59.4	18.0	18.0	62.8	26.0	15.1	58.1	62.0	60.8	56.3	36.8	40.4
Incremental Delay *(d_2)*, s/veh	10.7	0.2	0.2	10.4	0.4	4.3	0.1	36.8	9.7	15.5	0.1	0.8
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	70.1	18.2	18.2	73.3	26.4	19.4	58.2	98.8	70.5	71.8	36.9	41.2
Level of Service (LOS)	E	B	B	E	C	B	E	F	E	E	D	D
Approach Delay, s/veh / LOS	29.3	C		26.3	C		87.4	F		61.0	E	
Intersection Delay, s/veh / LOS	37.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	3.0	C	2.8	C
Bicycle LOS Score / LOS	1.1	A	1.9	A	0.8	A	1.6	A

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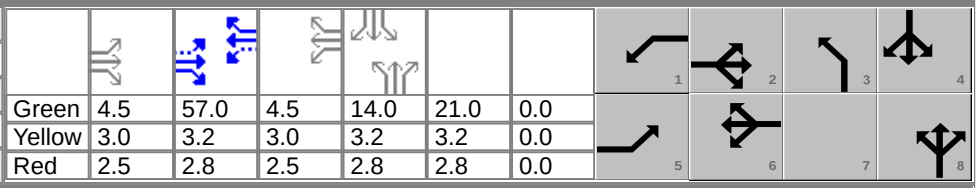
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.79
Intersection	River Dr. / 1st Ave. N	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	18_RiverDr_1stAveN_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	159	737	260	35	431	24	157	69	45	11	63	99

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.5	57.0	4.5	14.0	21.0	0.0
Yellow	3.0	3.2	3.0	3.2	3.2	0.0
Red	2.5	2.8	2.5	2.8	2.8	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.2	3.0	1.3	4.0		9.0		11.0
Phase Duration, s	10.0	73.0	10.0	73.0		27.0		20.0
Change Period, ($Y+R_c$), s	5.5	6.0	6.0	6.0		6.0		6.0
Max Allow Headway (*MAH*), s	3.2	0.0	3.2	0.0		4.2		4.3
Queue Clearance Time (g_s), s	6.5		2.0			17.4		13.3
Green Extension Time (g_e), s	0.0	0.0	0.4	0.0		0.4		0.1
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

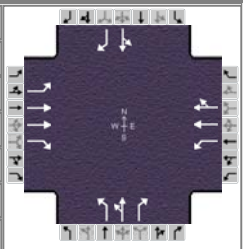
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	201	933	329	44	291	285	199	87	57		94	125
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1619	1618	1373	1619	1683	1647	1603	1683	1389		1638	1414
Queue Service Time (g_s), s	4.5	25.5	19.9	0.0	13.1	13.2	15.4	6.0	4.7		7.0	11.3
Cycle Queue Clearance Time (g_c), s	4.5	25.5	19.9	0.0	13.1	13.2	15.4	6.0	4.7		7.0	11.3
Capacity (*c*), veh/h	398	1668	708	241	867	849	259	272	224		176	152
Volume-to-Capacity Ratio (*X*)	0.506	0.559	0.465	0.184	0.335	0.336	0.767	0.321	0.254		0.531	0.823
Available Capacity (c_a), veh/h	398	1668	708	241	867	849	259	272	224		176	152
Back of Queue (*Q*), veh/ln (50th percentile)	3.0	9.9	4.8	1.0	5.4	5.3	7.1	2.6	1.7		3.1	5.3
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (*RQ*) (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
Uniform Delay (d_1), s/veh	26.7	21.4	11.2	32.0	18.5	18.5	52.2	48.2	47.7		54.9	56.8
Incremental Delay (d_2), s/veh	0.4	1.4	2.2	0.1	1.0	1.1	13.0	0.7	0.6		3.0	29.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	27.1	22.8	13.4	32.1	19.5	19.5	65.1	48.9	48.2		57.9	85.9
Level of Service (LOS)	C	C	B	C	B	B	E	D	D		E	F
Approach Delay, s/veh / LOS	21.3	C		20.4	C		58.2	E		73.9	E	
Intersection Delay, s/veh / LOS	30.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.5	B	2.3	B	2.9	C	3.1	C
Bicycle LOS Score / LOS	1.7	A	1.0	A	1.1	A	0.8	A

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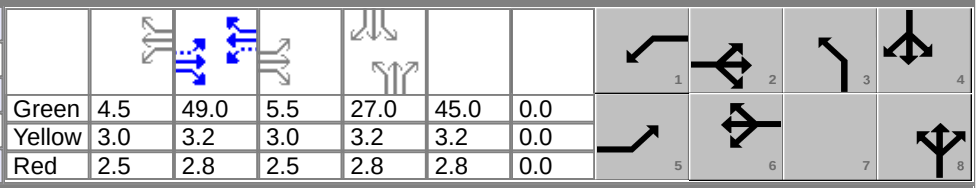
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.90
Intersection	River Dr. / 1st Ave. N	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	18_RiverDr_1stAveN_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	136	663	322	64	1009	19	541	90	95	27	94	317

Signal Information			
Cycle, s	160.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



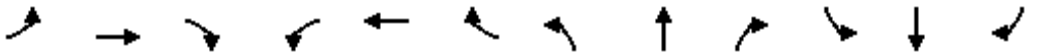
Green	4.5	49.0	5.5	27.0	45.0	0.0
Yellow	3.0	3.2	3.0	3.2	3.2	0.0
Red	2.5	2.8	2.5	2.8	2.8	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.3	3.0	1.2	4.0		9.0		11.0
Phase Duration, s	11.0	66.0	10.0	65.0		51.0		33.0
Change Period, ($Y+R_c$), s	6.0	6.0	5.5	6.0		6.0		6.0
Max Allow Headway (*MAH*), s	3.2	0.0	3.2	0.0		4.2		4.4
Queue Clearance Time (g_s), s	7.0		6.5			47.0		29.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

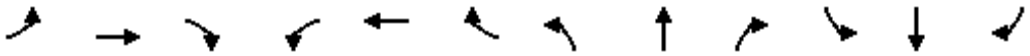
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	151	737	358	71	573	569	601	100	106		134	352
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1619	1618	1396	1619	1700	1687	1619	1683	1426		1665	1415
Queue Service Time (g_s), s	5.0	29.5	34.5	4.5	51.4	51.4	45.0	7.3	9.2		11.7	27.0
Cycle Queue Clearance Time (g_c), s	5.0	29.5	34.5	4.5	51.4	51.4	45.0	7.3	9.2		11.7	27.0
Capacity (*c*), veh/h	113	1214	523	154	627	622	455	473	401		281	239
Volume-to-Capacity Ratio (*X*)	1.336	0.607	0.684	0.460	0.914	0.915	1.320	0.211	0.263		0.479	1.476
Available Capacity (c_a), veh/h	113	1214	523	154	627	622	455	473	401		281	239
Back of Queue (*Q*), veh/ln (50th percentile)	10.9	12.2	13.0	2.0	25.3	25.1	38.5	3.1	3.3		5.1	20.8
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (*RQ*) (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
Uniform Delay (d_1), s/veh	75.7	40.5	42.0	40.8	48.1	48.1	57.5	43.9	44.6		60.1	21.7
Incremental Delay (d_2), s/veh	199.2	2.3	7.1	0.8	20.1	20.3	158.8	0.2	0.3		1.3	235.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	274.9	42.7	49.1	41.6	68.2	68.4	216.3	44.2	45.0		61.4	257.0
Level of Service (LOS)	F	D	D	D	E	E	F	D	D		E	F
Approach Delay, s/veh / LOS	72.7	E		66.7	E		172.6	F		202.9	F	
Intersection Delay, s/veh / LOS	109.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.3	B	2.9	C	3.1	C
Bicycle LOS Score / LOS	1.5	A	1.5	A	1.8	A	1.3	A

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	564	214	0	0	0	116	22	19	16	68	364
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850						0.850			0.850
Flt Protected		0.996					0.950	0.967		0.950		
Satd. Flow (prot)	0	3154	1417	0	0	0	1504	1531	1417	1583	1667	1417
Flt Permitted		0.996					0.950	0.967		0.950		
Satd. Flow (perm)	0	3154	1417	0	0	0	1504	1531	1417	1583	1667	1417
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			285						102			485
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1038			1127			1081			976	
Travel Time (s)		23.6			25.6			24.6			22.2	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Adj. Flow (vph)	61	752	285	0	0	0	155	29	25	21	91	485
Shared Lane Traffic (%)							41%					
Lane Group Flow (vph)	0	813	285	0	0	0	91	93	25	21	91	485
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1				1	2	1	1	2	1
Detector Template	Left	Thru	Right				Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20				20	100	20	20	100	20
Trailing Detector (ft)	0	0	0				0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0				0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20				20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94						94			94	
Detector 2 Size(ft)		6						6			6	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	
Turn Type	Perm	NA	Perm				Split	NA	Perm	Split	NA	Perm
Protected Phases		2					3	3		4	4	
Permitted Phases	2		2						3			4
Detector Phase	2	2	2				3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0				7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0				12.0	12.0	12.0	12.0	12.0	12.0

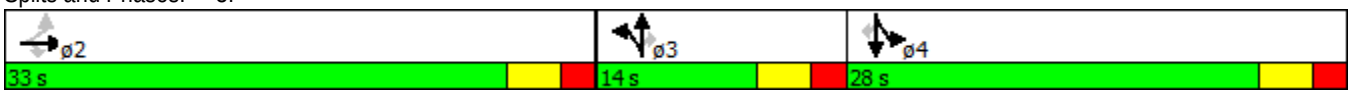


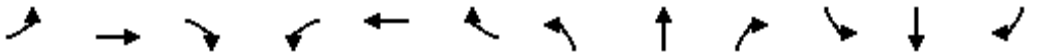
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)	33.0	33.0	33.0				14.0	14.0	14.0	28.0	28.0	28.0
Total Split (%)	44.0%	44.0%	44.0%				18.7%	18.7%	18.7%	37.3%	37.3%	37.3%
Maximum Green (s)	28.0	28.0	28.0				9.0	9.0	9.0	23.0	23.0	23.0
Yellow Time (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0				2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag							Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	Max				None	None	None	None	None	None
Walk Time (s)	5.0	5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0				11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	2	2	2				3	3	3	0	0	0
Act Effct Green (s)		29.1	29.1				9.5	9.5	9.5	11.4	11.4	11.4
Actuated g/C Ratio		0.47	0.47				0.15	0.15	0.15	0.18	0.18	0.18
v/c Ratio		0.55	0.35				0.40	0.40	0.08	0.07	0.30	0.74
Control Delay		16.7	3.8				31.8	31.8	0.5	22.4	25.7	10.3
Queue Delay		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		16.7	3.8				31.8	31.8	0.5	22.4	25.7	10.3
LOS		B	A				C	C	A	C	C	B
Approach Delay		13.4						28.0			13.1	
Approach LOS		B						C			B	
90th %ile Green (s)	28.0	28.0	28.0				16.0	16.0	16.0	23.0	23.0	23.0
90th %ile Term Code	MaxR	MaxR	MaxR				Ped	Ped	Ped	Max	Max	Max
70th %ile Green (s)	28.0	28.0	28.0				9.0	9.0	9.0	12.6	12.6	12.6
70th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
50th %ile Green (s)	28.0	28.0	28.0				9.0	9.0	9.0	9.6	9.6	9.6
50th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
30th %ile Green (s)	28.0	28.0	28.0				7.5	7.5	7.5	7.3	7.3	7.3
30th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Gap	Gap	Gap
10th %ile Green (s)	28.0	28.0	28.0				0.0	0.0	0.0	7.0	7.0	7.0
10th %ile Term Code	MaxR	MaxR	MaxR				Skip	Skip	Skip	Min	Min	Min
Stops (vph)		422	23				58	59	0	14	53	47
Fuel Used(gal)		9	2				1	1	0	0	1	4
CO Emissions (g/hr)		653	142				93	96	11	19	81	265
NOx Emissions (g/hr)		127	28				18	19	2	4	16	52
VOC Emissions (g/hr)		151	33				22	22	3	4	19	61
Dilemma Vehicles (#)		0	0				0	0	0	0	0	0
Queue Length 50th (ft)		110	0				32	33	0	7	31	0
Queue Length 95th (ft)		202	23				70	72	0	20	59	23
Internal Link Dist (ft)		958			1047			1001			896	
Turn Bay Length (ft)												
Base Capacity (vph)		1473	813				251	256	322	607	639	842
Starvation Cap Reductn		0	0				0	0	0	0	0	0
Spillback Cap Reductn		0	0				0	0	0	0	0	0
Storage Cap Reductn		0	0				0	0	0	0	0	0
Reduced v/c Ratio		0.55	0.35				0.36	0.36	0.08	0.03	0.14	0.58

Intersection Summary

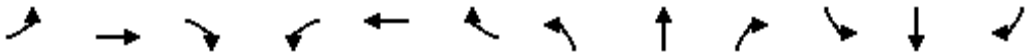
Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 62.2			
Natural Cycle: 45			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.74			
Intersection Signal Delay: 14.9		Intersection LOS: B	
Intersection Capacity Utilization 43.1%		ICU Level of Service A	
Analysis Period (min) 15			
90th %ile Actuated Cycle: 82			
70th %ile Actuated Cycle: 64.6			
50th %ile Actuated Cycle: 61.6			
30th %ile Actuated Cycle: 57.8			
10th %ile Actuated Cycle: 45			

Splits and Phases: 3:





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	617	174	0	0	0	432	20	51	9	43	526
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850						0.850			0.850
Flt Protected		0.996					0.950	0.956		0.950		
Satd. Flow (prot)	0	3154	1417	0	0	0	1504	1514	1417	1583	1667	1417
Flt Permitted		0.996					0.950	0.956		0.950		
Satd. Flow (perm)	0	3154	1417	0	0	0	1504	1514	1417	1583	1667	1417
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			183						102			554
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1038			1127			1081			976	
Travel Time (s)		23.6			25.6			24.6			22.2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	649	183	0	0	0	455	21	54	9	45	554
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	0	712	183	0	0	0	237	239	54	9	45	554
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1				1	2	1	1	2	1
Detector Template	Left	Thru	Right				Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20				20	100	20	20	100	20
Trailing Detector (ft)	0	0	0				0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0				0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20				20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94						94			94	
Detector 2 Size(ft)		6						6			6	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	
Turn Type	Perm	NA	Perm				Split	NA	Perm	Split	NA	Perm
Protected Phases		2					3	3		4	4	
Permitted Phases	2		2						3			4
Detector Phase	2	2	2				3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0				7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	21.0	21.0	21.0				12.0	12.0	12.0	12.0	12.0	12.0



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)	28.0	28.0	28.0				22.0	22.0	22.0	25.0	25.0	25.0
Total Split (%)	37.3%	37.3%	37.3%				29.3%	29.3%	29.3%	33.3%	33.3%	33.3%
Maximum Green (s)	23.0	23.0	23.0				17.0	17.0	17.0	20.0	20.0	20.0
Yellow Time (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0				2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag							Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	Max				None	None	None	None	None	None
Walk Time (s)	5.0	5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0				11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	7	7	7				2	2	2	2	2	2
Act Effct Green (s)		23.3	23.3				14.2	14.2	14.2	10.8	10.8	10.8
Actuated g/C Ratio		0.37	0.37				0.22	0.22	0.22	0.17	0.17	0.17
v/c Ratio		0.62	0.29				0.71	0.71	0.14	0.03	0.16	0.79
Control Delay		20.9	4.7				36.6	36.6	2.1	21.8	23.7	11.7
Queue Delay		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		20.9	4.7				36.6	36.6	2.1	21.8	23.7	11.7
LOS		C	A				D	D	A	C	C	B
Approach Delay		17.6						33.1			12.8	
Approach LOS		B						C			B	
90th %ile Green (s)	23.0	23.0	23.0				17.0	17.0	17.0	20.0	20.0	20.0
90th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Max	Max	Max
70th %ile Green (s)	23.0	23.0	23.0				17.0	17.0	17.0	13.8	13.8	13.8
70th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
50th %ile Green (s)	23.0	23.0	23.0				16.0	16.0	16.0	8.0	8.0	8.0
50th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Gap	Gap	Gap
30th %ile Green (s)	23.0	23.0	23.0				12.5	12.5	12.5	7.1	7.1	7.1
30th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Gap	Gap	Gap
10th %ile Green (s)	23.0	23.0	23.0				9.3	9.3	9.3	7.0	7.0	7.0
10th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Min	Min	Min
Stops (vph)		529	24				189	191	3	9	36	71
Fuel Used(gal)		11	2				5	5	0	0	1	6
CO Emissions (g/hr)		788	119				323	326	33	11	51	395
NOx Emissions (g/hr)		153	23				63	63	6	2	10	77
VOC Emissions (g/hr)		183	28				75	75	8	3	12	92
Dilemma Vehicles (#)		0	0				0	0	0	0	0	0
Queue Length 50th (ft)		111	0				82	83	0	3	15	0
Queue Length 95th (ft)		216	42				#208	#210	8	14	40	85
Internal Link Dist (ft)		958			1047			1001			896	
Turn Bay Length (ft)												
Base Capacity (vph)		1157	635				407	410	458	505	531	829
Starvation Cap Reductn		0	0				0	0	0	0	0	0
Spillback Cap Reductn		0	0				0	0	0	0	0	0
Storage Cap Reductn		0	0				0	0	0	0	0	0
Reduced v/c Ratio		0.62	0.29				0.58	0.58	0.12	0.02	0.08	0.67

Intersection Summary

Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 63.5			
Natural Cycle: 50			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.79			
Intersection Signal Delay: 20.2		Intersection LOS: C	
Intersection Capacity Utilization 58.7%		ICU Level of Service B	
Analysis Period (min) 15			
90th %ile Actuated Cycle: 75			
70th %ile Actuated Cycle: 68.8			
50th %ile Actuated Cycle: 62			
30th %ile Actuated Cycle: 57.6			
10th %ile Actuated Cycle: 54.3			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3:





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	372	18	62	0	0	87
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.76	0.90	0.71	0.92	0.92	0.75
Hourly flow rate (vph)	489	20	87	0	0	116
Pedestrians	9					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	1					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		999	9	1042	989
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		999	9	1042	989
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	70		49	100	100	33
cM capacity (veh/h)	1623		170	1065	97	172

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	326	183	87	116
Volume Left	326	163	0	0
Volume Right	0	20	0	0
cSH	1623	1623	170	172
Volume to Capacity	0.30	0.30	0.51	0.67
Queue Length 95th (ft)	32	32	64	99
Control Delay (s)	8.2	7.6	46.6	60.7
Lane LOS	A	A	E	F
Approach Delay (s)	7.9		46.6	60.7
Approach LOS			E	F

Intersection Summary			
Average Delay	21.3		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	558	25	79	0	0	100
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.62	0.82	0.92	0.92	0.83
Hourly flow rate (vph)	627	40	96	0	0	120
Pedestrians	2					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		1294	2	1324	1274
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		1294	2	1324	1274
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	61		3	100	100	0
cM capacity (veh/h)	1623		100	1080	12	103

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	418	249	96	120
Volume Left	418	209	0	0
Volume Right	0	40	0	0
cSH	1623	1623	100	103
Volume to Capacity	0.39	0.39	0.97	1.17
Queue Length 95th (ft)	47	47	145	198
Control Delay (s)	8.6	7.8	159.0	221.3
Lane LOS	A	A	F	F
Approach Delay (s)	8.3		159.0	221.3
Approach LOS			F	F

Intersection Summary			
Average Delay	53.7		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*River Dr. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* North/South Street: *River Drive South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*183*	*47*	*115*	*267*	
Peak-Hour Factor, PHF	*1.00*	*0.70*	*0.73*	*0.70*	*0.87*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*261*	*64*	*164*	*306*	*0*
Percent Heavy Vehicles	*0*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration			*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*11*		*104*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.69*	*1.00*	*0.79*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*15*	*0*	*131*
Percent Heavy Vehicles	*0*	*0*	*0*	*18*	*0*	*3*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*164*		*146*				
C (m) (veh/h)		*1240*		*611*				
v/c		*0.13*		*0.24*				
95% queue length		*0.46*		*0.93*				
Control Delay (s/veh)		*8.3*		*12.7*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*12.7*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*River Dr. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* North/South Street: *River Drive South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*161*	*33*	*79*	*331*	
Peak-Hour Factor, PHF	*1.00*	*0.76*	*0.69*	*0.86*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*211*	*47*	*91*	*359*	*0*
Percent Heavy Vehicles	*0*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration			*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*61*		*281*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.59*	*1.00*	*0.59*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*103*	*0*	*476*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*91*		*579*				
C (m) (veh/h)		*1293*		*630*				
v/c		*0.07*		*0.92*				
95% queue length		*0.23*		*11.89*				
Control Delay (s/veh)		*8.0*		*44.4*				
LOS		*A*		*E*				
Approach Delay (s/veh)	--	--	*44.4*					
Approach LOS	--	--	*E*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*2nd St. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* | North/South Street: *2nd Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*153*	*157*			*81*	*25*
Peak-Hour Factor, PHF	*0.71*	*0.77*	*1.00*	*1.00*	*0.81*	*0.69*
Hourly Flow Rate, HFR (veh/h)	*215*	*203*	*0*	*0*	*99*	*36*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*30*		*98*			
Peak-Hour Factor, PHF	*0.83*	*1.00*	*0.77*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*0*	*127*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*4*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*215*						*163*	
C (m) (veh/h)	*1449*						*658*	
v/c	*0.15*						*0.25*	
95% queue length	*0.52*						*0.97*	
Control Delay (s/veh)	*7.9*						*12.3*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--				*12.3*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*2nd St. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* | North/South Street: *2nd Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*286*	*170*			*219*	*45*
Peak-Hour Factor, PHF	*0.78*	*0.71*	*1.00*	*1.00*	*0.91*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*366*	*239*	*0*	*0*	*240*	*68*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*39*		*114*			
Peak-Hour Factor, PHF	*0.89*	*1.00*	*0.77*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*43*	*0*	*148*	*0*	*0*	*0*
Percent Heavy Vehicles	*3*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*366*						*191*	
C (m) (veh/h)	*1254*						*371*	
v/c	*0.29*						*0.51*	
95% queue length	*1.22*						*2.83*	
Control Delay (s/veh)	*9.0*						*24.6*	
LOS	*A*						*C*	
Approach Delay (s/veh)	--	--				*24.6*		
Approach LOS	--	--				*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / 18th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *18th Avenue SW* | North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*602*	*1*	*4*	*165*	*52*
Peak-Hour Factor, PHF	*0.31*	*0.71*	*0.25*	*0.50*	*0.88*	*0.65*
Hourly Flow Rate, HFR (veh/h)	*16*	*847*	*4*	*8*	*187*	*80*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration	*LTR*			*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*195*	*4*	*12*	*2*	*2*	*13*
Peak-Hour Factor, PHF	*0.81*	*0.50*	*0.75*	*0.50*	*0.50*	*0.54*
Hourly Flow Rate, HFR (veh/h)	*240*	*8*	*16*	*4*	*4*	*24*
Percent Heavy Vehicles	*1*	*0*	*8*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*L*		*LTR*			*LTR*	
v (veh/h)	*16*	*8*		*32*			*264*	
C (m) (veh/h)	*1304*	*796*		*288*			*169*	
v/c	*0.01*	*0.01*		*0.11*			*1.56*	
95% queue length	*0.04*	*0.03*		*0.37*			*17.52*	
Control Delay (s/veh)	*7.8*	*9.6*		*19.1*			*328.8*	
LOS	*A*	*A*		*C*			*F*	
Approach Delay (s/veh)	--	--	*19.1*			*328.8*		
Approach LOS	--	--	*C*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / 18th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *18th Avenue SW* | North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*310*	*0*	*13*	*612*	*167*
Peak-Hour Factor, PHF	*0.75*	*0.83*	*0.25*	*0.54*	*0.92*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*4*	*373*	*0*	*24*	*665*	*198*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration	*LTR*			*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*76*	*3*	*6*	*0*	*0*	*3*
Peak-Hour Factor, PHF	*0.79*	*0.38*	*0.50*	*0.25*	*0.25*	*0.38*
Hourly Flow Rate, HFR (veh/h)	*96*	*7*	*12*	*0*	*0*	*7*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*L*		*LTR*			*LTR*	
v (veh/h)	*4*	*24*		*7*			*115*	
C (m) (veh/h)	*788*	*1193*		*673*			*171*	
v/c	*0.01*	*0.02*		*0.01*			*0.67*	
95% queue length	*0.02*	*0.06*		*0.03*			*3.94*	
Control Delay (s/veh)	*9.6*	*8.1*		*10.4*			*61.0*	
LOS	*A*	*A*		*B*			*F*	
Approach Delay (s/veh)	--	--	*10.4*			*61.0*		
Approach LOS	--	--	*B*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / Park Garden Rd.*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Park Garden Road* North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*13*	*415*	*1*	*11*	*104*	*30*
Peak-Hour Factor, PHF	*0.81*	*0.79*	*0.25*	*0.31*	*0.59*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*16*	*525*	*4*	*35*	*176*	*40*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*102*	*3*	*5*	*1*	*8*	*36*
Peak-Hour Factor, PHF	*0.75*	*0.75*	*0.63*	*0.25*	*0.40*	*0.53*
Hourly Flow Rate, HFR (veh/h)	*136*	*4*	*7*	*4*	*19*	*67*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*35*		*90*			*147*	
C (m) (veh/h)	*1343*	*1047*		*441*			*222*	
v/c	*0.01*	*0.03*		*0.20*			*0.66*	
95% queue length	*0.04*	*0.10*		*0.76*			*4.09*	
Control Delay (s/veh)	*7.7*	*8.6*		*15.2*			*48.2*	
LOS	*A*	*A*		*C*			*E*	
Approach Delay (s/veh)	--	--	*15.2*			*48.2*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / Park Garden Rd.*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Park Garden Road* North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*195*	*5*	*46*	*391*	*130*
Peak-Hour Factor, PHF	*0.75*	*0.73*	*0.31*	*0.72*	*0.84*	*0.77*
Hourly Flow Rate, HFR (veh/h)	*24*	*267*	*16*	*63*	*465*	*168*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*69*	*6*	*25*	*6*	*8*	*27*
Peak-Hour Factor, PHF	*0.75*	*0.50*	*0.69*	*0.50*	*0.40*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*92*	*12*	*36*	*12*	*19*	*39*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*24*	*63*		*70*			*140*	
C (m) (veh/h)	*958*	*1287*		*321*			*213*	
v/c	*0.03*	*0.05*		*0.22*			*0.66*	
95% queue length	*0.08*	*0.15*		*0.82*			*4.00*	
Control Delay (s/veh)	*8.9*	*7.9*		*19.3*			*49.4*	
LOS	*A*	*A*		*C*			*E*	
Approach Delay (s/veh)	--	--	*19.3*			*49.4*		
Approach LOS	--	--	*C*			*E*		

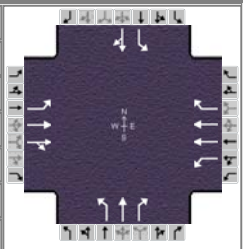
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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 1, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 2nd St.	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_2ndSt_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	92	1090	0	22	502	197	38	3	180	59	3	29

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.7	4.7	73.0	22.5	0.0	0.0	5	6	7	8
Yellow	3.6	3.0	3.6	4.0	0.0	0.0				
Red	1.7	3.3	2.4	2.5	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4		8
Case Number	1.1	4.0	1.1	3.0		5.0		6.0
Phase Duration, s	22.0	90.0	11.0	79.0		29.0		29.0
Change Period, *(Y+Rc)*, s	6.3	6.0	5.3	6.0		6.5		6.5
Max Allow Headway *(MAH)*, s	4.1	0.0	1.1	0.0		4.4		4.4
Queue Clearance Time *(g_s)*, s	3.9		2.8			19.3		8.3
Green Extension Time *(g_e)*, s	0.2	0.0	0.0	0.0		0.4		1.1
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.00			1.00		0.01

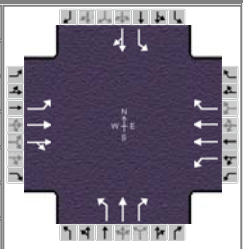
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	100	1185	0	24	546	214	41	3	196	64	35	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1603	1650	0	1619	1571	1441	1316	1700	1412	1202	1462	
Queue Service Time *(g_s)*, s	1.9	25.8	0.0	0.8	12.0	10.0	3.6	0.2	17.3	6.1	2.6	
Cycle Queue Clearance Time *(g_c)*, s	1.9	25.8	0.0	0.8	12.0	10.0	6.2	0.2	17.3	6.3	2.6	
Capacity *(c)*, veh/h	582	2133		342	1765	809	257	294	244	262	253	
Volume-to-Capacity Ratio *(X)*	0.172	0.555	0.000	0.070	0.309	0.265	0.161	0.011	0.800	0.245	0.137	
Available Capacity *(c_a)*, veh/h	582	2133		342	1765	809	257	294	244	262	253	
Back of Queue *(Q)*, veh/ln (50th percentile)	0.5	9.2		0.3	4.3	3.4	1.2	0.1	7.2	1.9	1.0	
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Uniform Delay *(d_1)*, s/veh	6.1	12.7		11.2	15.1	14.7	48.2	44.5	51.6	47.1	45.5	
Incremental Delay *(d_2)*, s/veh	0.1	1.0	0.0	0.0	0.5	0.8	0.3	0.0	17.0	0.5	0.2	
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay *(d)*, s/veh	6.2	13.7		11.2	15.6	15.5	48.4	44.5	68.6	47.6	45.8	
Level of Service (LOS)	A	B		B	B	B	D	D	E	D	D	
Approach Delay, s/veh / LOS	13.2	B		15.4	B		64.8	E		47.0	D	
Intersection Delay, s/veh / LOS	20.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.3	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.5	A	1.1	A	0.9	A	0.7	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 1, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 2nd St.	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_2ndSt_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	48	974	0	54	1555	277	56	3	190	156	15	208

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4		
Green	5.7	2.7	62.0	20.5	0.0	0.0	5	6	7	8		
Yellow	3.6	3.0	3.6	4.0	0.0	0.0						
Red	1.7	3.3	2.4	2.5	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4		8
Case Number	1.1	4.0	1.1	3.0		5.0		6.0
Phase Duration, s	20.0	77.0	11.0	68.0		27.0		27.0
Change Period, *(Y+Rc)*, s	6.3	6.0	5.3	6.0		6.5		6.5
Max Allow Headway *(MAH)*, s	4.1	0.0	1.1	0.0		4.5		4.5
Queue Clearance Time *(gs)*, s	2.9		3.8			22.5		20.9
Green Extension Time *(ge)*, s	0.1	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.09			1.00		1.00

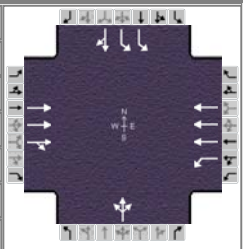
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	52	1059	0	59	1690	301	61	3	207	170	242	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1667	0	1587	1602	1441	1122	1700	1422	1179	1456	
Queue Service Time *(gs)*, s	0.9	20.5	0.0	1.8	59.1	14.0	1.6	0.2	16.1	15.9	18.9	
Cycle Queue Clearance Time *(gc)*, s	0.9	20.5	0.0	1.8	59.1	14.0	20.5	0.2	16.1	16.1	18.9	
Capacity *(c)*, veh/h	261	2058		374	1728	777	78	303	253	271	259	
Volume-to-Capacity Ratio *(X)*	0.200	0.514	0.000	0.157	0.978	0.388	0.776	0.011	0.815	0.626	0.934	
Available Capacity *(ca)*, veh/h	261	2058		374	1728	777	78	303	253	271	259	
Back of Queue *(Q)*, veh/ln (50th percentile)	0.9	7.3		0.6	24.8	4.7	2.6	0.1	6.9	4.9	9.5	
Overflow Queue *(Q3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Uniform Delay *(d1)*, s/veh	26.6	12.3		10.7	25.8	15.4	57.3	38.9	45.4	45.5	46.6	
Incremental Delay *(d2)*, s/veh	0.4	0.9	0.0	0.1	17.1	1.5	37.6	0.0	18.2	4.5	38.4	
Initial Queue Delay *(d3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay *(d)*, s/veh	27.0	13.3		10.8	42.9	16.9	94.9	38.9	63.6	50.0	85.0	
Level of Service (LOS)	C	B		B	D	B	F	D	E	D	F	
Approach Delay, s/veh / LOS	13.9	B		38.2	D		70.4	E		70.6	E	
Intersection Delay, s/veh / LOS	36.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.3	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.4	A	2.2	B	0.9	A	1.2	A

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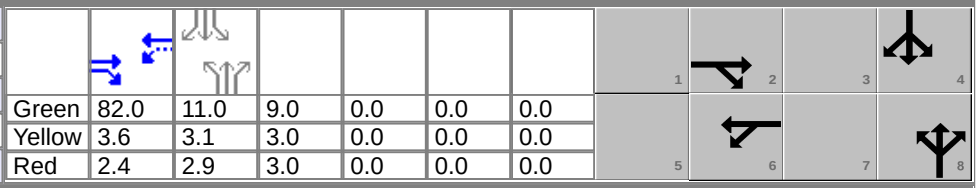
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 7, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.88
Intersection	10th Ave. S / 5th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_5thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1345	17	14	909		42	0	19	104	32	50

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	82.0	11.0	9.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		10.0
Phase Duration, s		88.0		88.0		15.0		17.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.2		4.2
Queue Clearance Time *(g_s)*, s						7.2		9.5
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.1
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

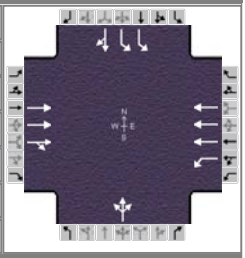
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1034	514	16	1033			69		118	93	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1650	1639	339	1484			1557		1456	1451	
Queue Service Time *(g_s)*, s		17.3	17.3	2.7	11.5			5.2		4.6	7.5	
Cycle Queue Clearance Time *(g_c)*, s		17.3	17.3	20.1	11.5			5.2		4.6	7.5	
Capacity *(c)*, veh/h		2256	1120	243	3043			117		267	133	
Volume-to-Capacity Ratio *(X)*		0.458	0.458	0.065	0.339			0.594		0.443	0.701	
Available Capacity *(c_a)*, veh/h		2256	1120	243	3043			117		267	133	
Back of Queue *(Q)*, veh/ln (50th percentile)		5.8	6.0	0.2	3.4			2.3		1.7	3.3	
Overflow Queue *(Q_3)*, veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	
Uniform Delay *(d_1)*, s/veh		8.8	8.8	13.4	7.8			53.7		51.6	52.9	
Incremental Delay *(d_2)*, s/veh		0.7	1.4	0.5	0.3			7.8		1.2	15.1	
Initial Queue Delay *(d_3)*, s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Control Delay *(d)*, s/veh		9.4	10.1	13.9	8.1			61.6		52.8	68.0	
Level of Service (LOS)		A	B	B	A			E		D	E	
Approach Delay, s/veh / LOS	9.7	A		8.2	A		61.6	E		59.5	E	
Intersection Delay, s/veh / LOS	14.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.3	A	1.1	A	0.6	A	0.8	A

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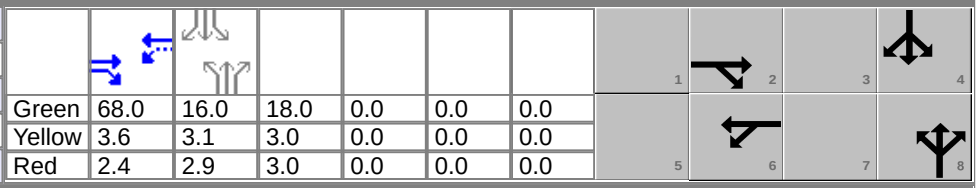
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 7, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.90
Intersection	10th Ave. S / 5th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_5thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1370	24	31	1653		144	0	46	224	44	118

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	68.0	16.0	18.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		10.0
Phase Duration, s		74.0		74.0		24.0		22.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.2		4.2
Queue Clearance Time *(g_s)*, s						17.9		16.5
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

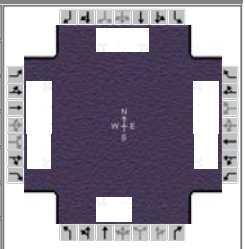
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1036	513	34	1837			211		249	180	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1683	1668	339	1513			1567		1541	1473	
Queue Service Time *(g_s)*, s		23.1	23.1	8.5	35.3			15.9		9.1	14.5	
Cycle Queue Clearance Time *(g_c)*, s		23.1	23.1	31.6	35.3			15.9		9.1	14.5	
Capacity *(c)*, veh/h		1908	945	187	2573			235		411	196	
Volume-to-Capacity Ratio *(X)*		0.543	0.543	0.184	0.714			0.898		0.606	0.916	
Available Capacity *(c_a)*, veh/h		1908	945	187	2573			235		411	196	
Back of Queue *(Q)*, veh/ln (50th percentile)		8.8	9.0	0.8	12.1			8.3		3.6	7.5	
Overflow Queue *(Q_3)*, veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	
Uniform Delay *(d_1)*, s/veh		16.3	16.3	26.2	18.9			50.1		49.0	51.3	
Incremental Delay *(d_2)*, s/veh		1.1	2.2	2.2	1.7			33.0		2.5	41.4	
Initial Queue Delay *(d_3)*, s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Control Delay *(d)*, s/veh		17.4	18.5	28.3	20.6			83.1		51.6	92.8	
Level of Service (LOS)		B	B	C	C			F		D	F	
Approach Delay, s/veh / LOS	17.8	B		20.8	C		83.1	F		68.9	E	
Intersection Delay, s/veh / LOS	28.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.3	A	1.5	A	0.8	A	1.2	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.80
Intersection	10th Ave. S / 9th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_9thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	111	1239	43	21	953	140	54	26	16	119	36	83

Signal Information			
Cycle, s	105.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.7	3.7	64.0	11.0	0.0	0.0	5	6	7	8
Yellow	3.7	3.7	3.7	3.0	0.0	0.0				
Red	1.6	1.6	2.3	1.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	3.0	1.1	3.0		6.0		5.0
Phase Duration, s	20.0	79.0	11.0	70.0		15.0		15.0
Change Period, *(Y+Rc)*, s	5.3	6.0	5.3	6.0		4.0		4.0
Max Allow Headway *(MAH)*, s	1.1	0.0	1.1	0.0		1.2		1.2
Queue Clearance Time *(g_s)*, s	3.4		2.6			10.0		13.0
Green Extension Time *(g_e)*, s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.00			1.00		1.00

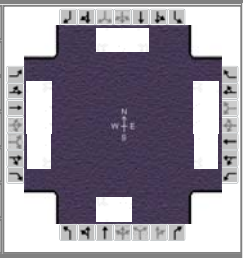
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	139	1549	54	26	1191	175	68	53		149	45	104
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1544	1441	1619	1544	1441	1258	1591		1373	1700	1441
Queue Service Time *(g_s)*, s	1.4	16.1	1.2	0.6	14.2	5.7	5.5	3.2		7.8	2.6	7.3
Cycle Queue Clearance Time *(g_c)*, s	1.4	16.1	1.2	0.6	14.2	5.7	8.0	3.2		11.0	2.6	7.3
Capacity *(c)*, veh/h	487	3220	1002	331	2823	878	170	167		170	178	151
Volume-to-Capacity Ratio *(X)*	0.285	0.481	0.054	0.079	0.422	0.199	0.398	0.315		0.873	0.253	0.687
Available Capacity *(c_a)*, veh/h	487	3220	1002	331	2823	878	170	167		170	178	151
Back of Queue *(Q)*, veh/ln (50th percentile)	0.8	4.6	0.4	0.2	4.5	1.8	1.7	1.3		5.5	1.1	3.0
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	5.8	7.3	5.1	6.3	10.8	9.1	46.9	43.5		49.8	43.2	45.3
Incremental Delay *(d_2)*, s/veh	0.1	0.5	0.1	0.0	0.5	0.5	0.6	0.4		34.5	0.3	10.4
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	5.9	7.8	5.2	6.3	11.2	9.6	47.5	43.9		84.4	43.5	55.7
Level of Service (LOS)	A	A	A	A	B	A	D	D		F	D	E
Approach Delay, s/veh / LOS	7.6	A		10.9	B		45.9	D		68.2	E	
Intersection Delay, s/veh / LOS	15.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	3.4	C	3.4	C
Bicycle LOS Score / LOS	1.4	A	1.3	A	0.7	A	1.0	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.95
Intersection	10th Ave. S / 9th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_9thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	138	1348	115	53	1457	179	160	70	51	281	77	175

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.7	2.7	42.0	24.0	0.0	0.0	5	6	7	8
Yellow	3.7	3.7	3.7	3.0	0.0	0.0				
Red	1.6	1.6	2.3	1.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	3.0	1.1	3.0		6.0		5.0
Phase Duration, s	19.0	56.0	11.0	48.0		28.0		28.0
Change Period, $(Y+R_c)$, s	5.3	6.0	5.3	6.0		4.0		4.0
Max Allow Headway *(MAH)*, s	1.1	0.0	1.1	0.0		1.4		1.4
Queue Clearance Time (g_s), s	4.9		3.7			18.7		26.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.1		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.06			0.01		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	145	1419	121	56	1534	188	168	127		296	81	184
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1603	1513	1426	1619	1513	1441	1121	1580		1283	1700	1426
Queue Service Time (g_s), s	2.9	20.5	4.2	1.7	27.0	8.0	13.2	6.2		17.8	3.6	10.5
Cycle Queue Clearance Time (g_c), s	2.9	20.5	4.2	1.7	27.0	8.0	16.7	6.2		24.0	3.6	10.5
Capacity *(c)*, veh/h	352	2389	751	279	2007	637	317	399		316	429	360
Volume-to-Capacity Ratio *(X)*	0.413	0.594	0.161	0.200	0.764	0.296	0.531	0.319		0.936	0.189	0.511
Available Capacity (c_a), veh/h	352	2389	751	279	2007	637	317	399		316	429	360
Back of Queue *(Q)*, veh/ln (50th percentile)	1.7	6.7	1.3	0.6	9.5	2.7	3.6	2.3		9.9	1.4	3.6
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh	16.9	15.5	11.6	13.2	22.3	17.0	34.4	28.9		40.3	27.9	30.5
Incremental Delay (d_2), s/veh	0.3	1.1	0.5	0.1	2.8	1.2	0.9	0.2		33.9	0.1	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	17.2	16.6	12.1	13.3	25.2	18.2	35.3	29.0		74.2	27.9	31.0
Level of Service (LOS)	B	B	B	B	C	B	D	C		E	C	C
Approach Delay, s/veh / LOS	16.3	B		24.0	C		32.6	C		53.3	D	
Intersection Delay, s/veh / LOS	25.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.4	B	3.4	C	3.4	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	1.0	A	1.4	A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*13th Ave. S / 9th St.S*
Jurisdiction	*Great Falls*
Analysis Year	*Existing - 2013*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* North/South Street: *9th Street South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*112*	*18*	*28*	*167*	*41*
Peak-Hour Factor, PHF	*0.63*	*0.70*	*0.64*	*0.54*	*0.67*	*0.60*
Hourly Flow Rate, HFR (veh/h)	*7*	*160*	*28*	*51*	*249*	*68*
Percent Heavy Vehicles	*0*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*8*	*34*	*6*	*15*	*31*	*18*
Peak-Hour Factor, PHF	*0.67*	*0.71*	*0.75*	*0.54*	*0.71*	*0.56*
Hourly Flow Rate, HFR (veh/h)	*11*	*47*	*8*	*27*	*43*	*32*
Percent Heavy Vehicles	*0*	*3*	*17*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*7*	*51*		*102*			*66*	
C (m) (veh/h)	*1255*	*1370*		*457*			*409*	
v/c	*0.01*	*0.04*		*0.22*			*0.16*	
95% queue length	*0.02*	*0.12*		*0.85*			*0.57*	
Control Delay (s/veh)	*7.9*	*7.7*		*15.1*			*15.5*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*15.1*			*15.5*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*13th Ave. S / 9th St.S*
Jurisdiction	*Great Falls*
Analysis Year	*Existing - 2013*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* | North/South Street: *9th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*13*	*181*	*35*	*64*	*115*	*82*
Peak-Hour Factor, PHF	*0.81*	*0.91*	*0.80*	*0.62*	*0.87*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*16*	*198*	*43*	*103*	*132*	*100*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*27*	*69*	*10*	*14*	*87*	*42*
Peak-Hour Factor, PHF	*0.68*	*0.82*	*0.50*	*0.58*	*0.78*	*0.70*
Hourly Flow Rate, HFR (veh/h)	*39*	*84*	*20*	*24*	*111*	*60*
Percent Heavy Vehicles	*4*	*0*	*0*	*0*	*1*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

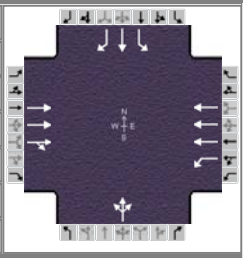
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*103*		*195*			*143*	
C (m) (veh/h)	*1348*	*1319*		*389*			*317*	
v/c	*0.01*	*0.08*		*0.50*			*0.45*	
95% queue length	*0.04*	*0.25*		*2.71*			*2.24*	
Control Delay (s/veh)	*7.7*	*8.0*		*23.2*			*25.4*	
LOS	*A*	*A*		*C*			*D*	
Approach Delay (s/veh)	--	--	*23.2*			*25.4*		
Approach LOS	--	--	*C*			*D*		

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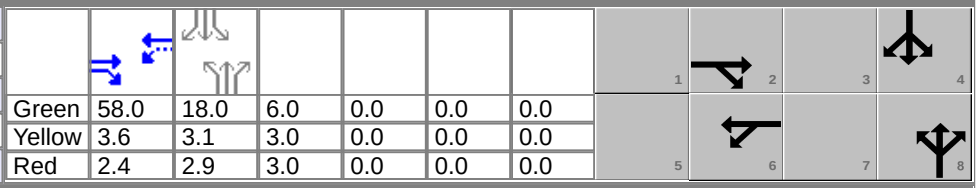
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/8/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.82
Intersection	10th Ave. S / 14th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_14thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1066	26	20	1098		7	0	8	139	86	157

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	58.0	18.0	6.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		9.0
Phase Duration, s		64.0		64.0		12.0		24.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		3.3		3.2
Queue Clearance Time (g_s), s						3.1		15.2
Green Extension Time (g_e), s		0.0		0.0		0.0		0.3
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

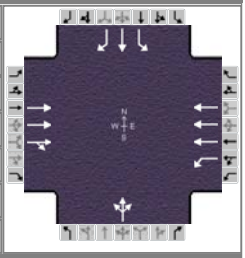
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		892	440	24	1339			18		170	105	191
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1650	1629	418	1499			1514		1619	1683	1385
Queue Service Time (g_s), s		15.5	15.5	3.6	17.8			1.1		9.6	5.4	13.2
Cycle Queue Clearance Time (g_c), s		15.5	15.5	19.1	17.8			1.1		9.6	5.4	13.2
Capacity *(c)*, veh/h		1915	945	249	2608			91		291	303	249
Volume-to-Capacity Ratio *(X)*		0.466	0.466	0.098	0.514			0.201		0.582	0.346	0.768
Available Capacity (c_a), veh/h		1915	945	249	2608			91		291	303	249
Back of Queue *(Q)*, veh/ln (50th percentile)		5.4	5.6	0.4	5.6			0.4		3.9	2.2	5.2
Overflow Queue (Q_3), veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		12.1	12.1	17.6	12.6			44.7		37.6	35.9	39.0
Incremental Delay (d_2), s/veh		0.8	1.6	0.8	0.7			0.4		2.0	0.3	12.2
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		12.9	13.7	18.4	13.3			45.1		39.5	36.1	51.3
Level of Service (LOS)		B	B	B	B			D		D	D	D
Approach Delay, s/veh / LOS	13.2	B		13.4	B		45.1	D		43.6	D	
Intersection Delay, s/veh / LOS	17.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.2	A	1.2	A	0.5	A	1.3	A

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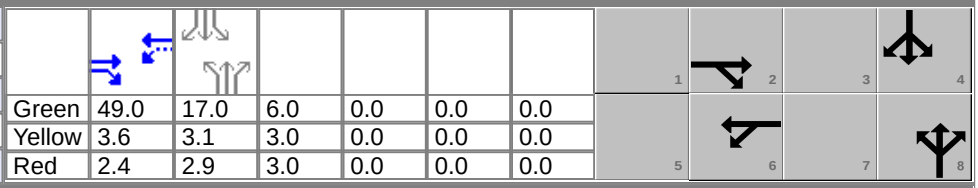
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/8/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.95
Intersection	10th Ave. S / 14th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_14thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1576	37	25	1490		30	0	31	233	142	199

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	49.0	17.0	6.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		9.0
Phase Duration, s		55.0		55.0		12.0		23.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.3		4.2
Queue Clearance Time (g_s), s						5.7		15.0
Green Extension Time (g_e), s		0.0		0.0		0.0		0.5
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

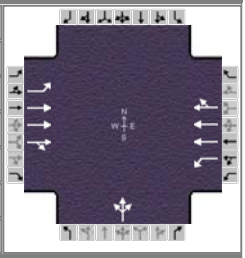
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1137	561	26	1568			64		245	149	209
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1683	1662	294	1499			1523		1619	1650	1390
Queue Service Time (g_s), s		20.9	20.9	6.1	22.0			3.7		13.0	7.3	13.0
Cycle Queue Clearance Time (g_c), s		20.9	20.9	27.0	22.0			3.7		13.0	7.3	13.0
Capacity *(c)*, veh/h		1833	905	172	2448			102		306	312	263
Volume-to-Capacity Ratio *(X)*		0.620	0.620	0.153	0.641			0.632		0.802	0.479	0.798
Available Capacity (c_a), veh/h		1833	905	172	2448			102		306	312	263
Back of Queue *(Q)*, veh/ln (50th percentile)		7.5	7.8	0.5	6.9			1.7		6.2	2.9	5.4
Overflow Queue (Q_3), veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		14.1	14.1	23.4	14.3			40.9		34.9	32.6	34.9
Incremental Delay (d_2), s/veh		1.6	3.2	1.9	1.3			12.0		14.2	1.1	15.8
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		15.7	17.3	25.3	15.6			53.0		49.1	33.7	50.6
Level of Service (LOS)		B	B	C	B			D		D	C	D
Approach Delay, s/veh / LOS	16.2	B		15.8	B		53.0	D		45.8	D	
Intersection Delay, s/veh / LOS	21.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.4	A	0.6	A	1.5	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.85
Intersection	10th Ave. S / 15th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_15thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	119	1139	9	4	1087	143	20	64	11			

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	4.9	82.8	10.5	0.0	0.0	0.0				
Yellow	3.6	3.6	3.0	0.0	0.0	0.0				
Red	1.2	2.4	3.0	0.0	0.0	0.0	5	6	7	8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		4		
Case Number	1.0	4.0		6.3		12.0		
Phase Duration, s	9.7	98.5		88.8		16.5		
Change Period, *(Y+Rc)*, s	4.8	6.0		6.0		6.0		
Max Allow Headway *(MAH)*, s	4.1	0.0		0.0		3.1		
Queue Clearance Time *(g_s)*, s	4.5					9.8		
Green Extension Time *(g_e)*, s	0.4	0.0		0.0		0.1		
Phase Call Probability	0.99					0.97		
Max Out Probability	0.00					0.02		

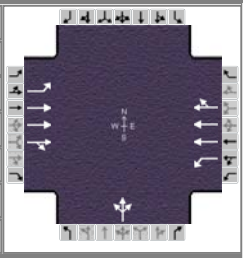
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14			
Adjusted Flow Rate *(v)*, veh/h	140	902	449	5	985	462		112				
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1572	1650	1644	410	1683	1578		1615				
Queue Service Time *(g_s)*, s	2.5	8.5	8.5	0.4	13.3	13.3		7.8				
Cycle Queue Clearance Time *(g_c)*, s	2.5	8.5	8.5	0.4	13.3	13.3		7.8				
Capacity *(c)*, veh/h	349	2656	1322	358	2423	1136		147				
Volume-to-Capacity Ratio *(X)*	0.401	0.340	0.340	0.013	0.407	0.407		0.759				
Available Capacity *(c_a)*, veh/h	565	2656	1322	358	2423	1136		225				
Back of Queue *(Q)*, veh/ln (50th percentile)	0.7	2.1	2.2	0.0	4.2	4.2		3.2				
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00				
Uniform Delay *(d_1)*, s/veh	4.7	3.0	3.0	4.6	6.4	6.4		51.0				
Incremental Delay *(d_2)*, s/veh	0.7	0.3	0.7	0.1	0.5	1.1		3.0				
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Control Delay *(d)*, s/veh	5.5	3.4	3.7	4.6	6.9	7.5		54.0				
Level of Service (LOS)	A	A	A	A	A	A		D				
Approach Delay, s/veh / LOS	3.7	A		7.1	A		54.0	D		0.0		
Intersection Delay, s/veh / LOS	7.1						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.0	B	1.9	A	3.3	C	3.3	C
Bicycle LOS Score / LOS	1.3	A	1.3	A	0.7	A		

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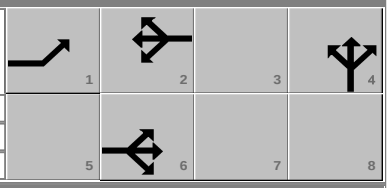
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.97
Intersection	10th Ave. S / 15th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_15thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	227	1644	40	20	1477	253	41	144	12			

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.1	73.5	16.6	0.0	0.0	0.0			
Yellow	3.6	3.6	3.0	0.0	0.0	0.0			
Red	1.2	2.4	3.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		4		
Case Number	1.0	4.0		6.3		12.0		
Phase Duration, s	12.9	92.4		79.5		22.6		
Change Period, *(Y+Rc)*, s	4.8	6.0		6.0		6.0		
Max Allow Headway *(MAH)*, s	4.1	0.0		0.0		3.1		
Queue Clearance Time *(g_s)*, s	7.4					15.7		
Green Extension Time *(g_e)*, s	0.7	0.0		0.0		0.3		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.00					0.00		

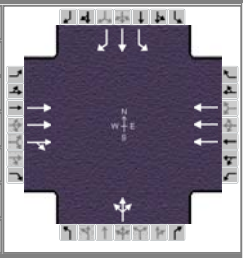
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14			
Adjusted Flow Rate *(v)*, veh/h	234	1162	574	21	1219	564		203				
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1603	1683	1662	283	1700	1567		1664				
Queue Service Time *(g_s)*, s	5.4	15.1	15.1	3.4	23.2	23.3		13.7				
Cycle Queue Clearance Time *(g_c)*, s	5.4	15.1	15.1	5.6	23.2	23.3		13.7				
Capacity *(c)*, veh/h	292	2529	1249	238	2173	1001		240				
Volume-to-Capacity Ratio *(X)*	0.801	0.459	0.460	0.087	0.561	0.563		0.846				
Available Capacity *(c_a)*, veh/h	550	2529	1249	238	2173	1001		420				
Back of Queue *(Q)*, veh/ln (50th percentile)	4.6	4.5	4.6	0.2	8.3	8.1		5.8				
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00				
Uniform Delay *(d_1)*, s/veh	17.3	5.4	5.4	8.9	11.7	11.7		48.0				
Incremental Delay *(d_2)*, s/veh	5.1	0.6	1.2	0.7	1.1	2.3		3.2				
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Control Delay *(d)*, s/veh	22.4	6.0	6.7	9.7	12.7	14.0		51.1				
Level of Service (LOS)	C	A	A	A	B	B		D				
Approach Delay, s/veh / LOS	8.2	A		13.1	B		51.1	D		0.0		
Intersection Delay, s/veh / LOS	12.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.0	B	1.9	A	3.3	C	3.3	C
Bicycle LOS Score / LOS	1.6	A	1.5	A	0.8	A		

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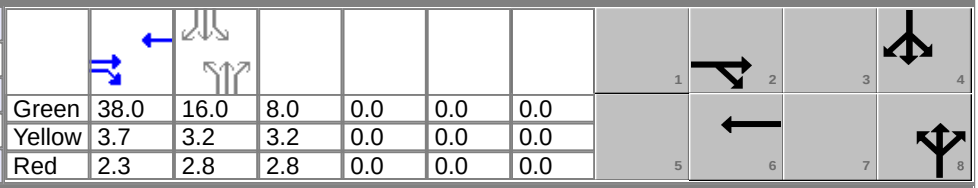
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 25th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_25thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1033	16		1028		12	0	12	226	112	161

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	38.0	16.0	8.0	0.0	0.0	0.0			
Yellow	3.7	3.2	3.2	0.0	0.0	0.0			
Red	2.3	2.8	2.8	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		12.0		9.0
Phase Duration, s		44.0		44.0		14.0		22.0
Change Period, $(Y+R_c)$, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.3		4.2
Queue Clearance Time (g_s), s						3.3		13.4
Green Extension Time (g_e), s		0.0		0.0		0.0		0.6
Phase Call Probability						1.00		1.00
Max Out Probability						0.51		1.00

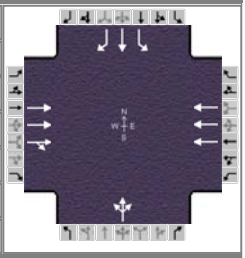
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12		6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		762	378		1117			26		246	122	175
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1700	1686		1544			1525		1619	1700	1441
Queue Service Time (g_s), s		12.1	12.1		13.4			1.3		11.4	4.9	8.8
Cycle Queue Clearance Time (g_c), s		12.1	12.1		13.4			1.3		11.4	4.9	8.8
Capacity *(c)*, veh/h		1615	801		2200			152		324	340	288
Volume-to-Capacity Ratio *(X)*		0.472	0.472		0.508			0.171		0.759	0.358	0.607
Available Capacity (c_a), veh/h		1615	801		2200			152		324	340	288
Back of Queue *(Q)*, veh/ln (50th percentile)		4.4	4.6		4.4			0.5		5.1	2.0	3.2
Overflow Queue (Q_3), veh/ln		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00		0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		14.2	14.2		14.5			33.0		30.2	27.6	29.1
Incremental Delay (d_2), s/veh		1.0	2.0		0.8			0.5		9.9	0.6	3.6
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		15.2	16.2		15.4			33.5		40.1	28.2	32.8
Level of Service (LOS)		B	B		B			C		D	C	C
Approach Delay, s/veh / LOS	15.5	B		15.4	B		33.5	C		35.1	D	
Intersection Delay, s/veh / LOS	19.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.1	A	1.1	A	0.5	A	1.4	A

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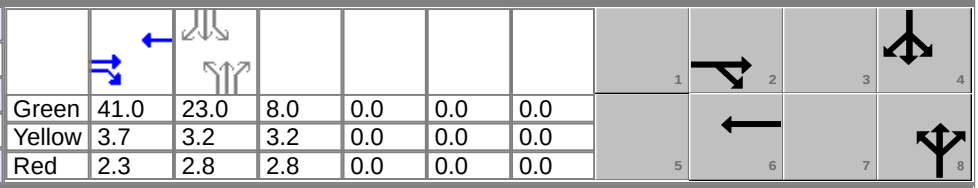
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 25th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_25thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1514	27		1378		42	0	14	181	118	191

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	41.0	23.0	8.0	0.0	0.0	0.0			
Yellow	3.7	3.2	3.2	0.0	0.0	0.0			
Red	2.3	2.8	2.8	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		12.0		9.0
Phase Duration, s		47.0		47.0		14.0		29.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.2		4.2
Queue Clearance Time (g_s), s						5.3		13.3
Green Extension Time (g_e), s		0.0		0.0		0.0		1.5
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		0.14

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12		6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1120	555		1498			61		197	128	208
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1700	1684		1544			1570		1619	1700	1441
Queue Service Time (g_s), s		24.1	24.1		23.4			3.3		9.3	5.5	11.3
Cycle Queue Clearance Time (g_c), s		24.1	24.1		23.4			3.3		9.3	5.5	11.3
Capacity *(c)*, veh/h		1549	767		2110			140		414	434	368
Volume-to-Capacity Ratio *(X)*		0.723	0.723		0.710			0.436		0.475	0.295	0.564
Available Capacity (c_a), veh/h		1549	767		2110			140		414	434	368
Back of Queue *(Q)*, veh/ln (50th percentile)		9.4	9.9		8.1			1.3		3.6	2.2	4.0
Overflow Queue (Q_3), veh/ln		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00		0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		19.9	19.9		19.7			38.9		28.4	27.0	29.1
Incremental Delay (d_2), s/veh		3.0	5.9		2.1			2.1		0.8	0.4	2.0
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		22.9	25.8		21.8			41.0		29.2	27.3	31.1
Level of Service (LOS)		C	C		C			D		C	C	C
Approach Delay, s/veh / LOS	23.8	C		21.8	C		41.0	D		29.5	C	
Intersection Delay, s/veh / LOS	24.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.3	A	0.6	A	1.4	A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Trisha Bodlovic*	Intersection	*11th Ave. S / 26th St. S*
Agency/Co.	*Robert Peccia & Associates*	Jurisdiction	*Great Falls*
Date Performed	*6/27/2013*	Analysis Year	*2013 - Existing*
Analysis Time Period	*AM Peak Hour*		

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*1*	*191*	*38*	*123*	*291*	*0*
Peak-Hour Factor, PHF	*0.25*	*0.87*	*0.68*	*0.79*	*0.69*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*4*	*219*	*55*	*155*	*421*	*0*
Percent Heavy Vehicles	*0*	--	--		--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*1*	*1*
Configuration	*LT*		*TR*	*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*2*	*1*	*0*	*27*	*1*	*88*
Peak-Hour Factor, PHF	*0.25*	*0.25*	*0.25*	*0.68*	*0.25*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*8*	*4*	*0*	*39*	*4*	*100*
Percent Heavy Vehicles	*17*	*25*	*0*	*1*	*9*	*1*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*4*	*155*	*43*		*100*		*12*	
C (m) (veh/h)	*1149*	*1286*	*175*		*914*		*174*	
v/c	*0.00*	*0.12*	*0.25*		*0.11*		*0.07*	
95% queue length	*0.01*	*0.41*	*0.93*		*0.37*		*0.22*	
Control Delay (s/veh)	*8.1*	*8.2*	*32.1*		*9.4*		*27.2*	
LOS	*A*	*A*	*D*		*A*		*D*	
Approach Delay (s/veh)	--	--	*16.3*			*27.2*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*11th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*2*	*393*	*49*	*120*	*161*	*4*
Peak-Hour Factor, PHF	*0.50*	*0.86*	*0.53*	*0.94*	*0.92*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*4*	*456*	*92*	*127*	*174*	*8*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*1*	*1*
Configuration	*LT*		*TR*	*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*0*	*1*	*1*	*42*	*2*	*294*
Peak-Hour Factor, PHF	*0.25*	*0.25*	*0.25*	*0.75*	*0.50*	*0.81*
Hourly Flow Rate, HFR (veh/h)	*0*	*4*	*4*	*56*	*4*	*362*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*4*	*127*	*60*		*362*		*8*	
C (m) (veh/h)	*1405*	*1032*	*193*		*770*		*345*	
v/c	*0.00*	*0.12*	*0.31*		*0.47*		*0.02*	
95% queue length	*0.01*	*0.42*	*1.26*		*2.54*		*0.07*	
Control Delay (s/veh)	*7.6*	*9.0*	*31.9*		*13.8*		*15.7*	
LOS	*A*	*A*	*D*		*B*		*C*	
Approach Delay (s/veh)	--	--	*16.3*			*15.7*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Trisha Bodlovic*	Intersection	*13th Ave. S / 26th St. S*
Agency/Co.	*Robert Peccia & Associates*	Jurisdiction	*Great Falls*
Date Performed		Analysis Year	*2013 - Existing*
Analysis Time Period	*AM Peak Hour*		

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*12*	*190*	*5*	*29*	*287*	*26*
Peak-Hour Factor, PHF	*0.60*	*0.74*	*0.63*	*0.66*	*0.84*	*0.43*
Hourly Flow Rate, HFR (veh/h)	*19*	*256*	*7*	*43*	*341*	*60*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*2*	*10*	*1*	*1*	*4*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.36*	*0.25*	*0.25*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*7*	*8*	*27*	*4*	*4*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*19*	*43*		*16*			*42*	
C (m) (veh/h)	*1159*	*1309*		*486*			*531*	
v/c	*0.02*	*0.03*		*0.03*			*0.08*	
95% queue length	*0.05*	*0.10*		*0.10*			*0.26*	
Control Delay (s/veh)	*8.2*	*7.8*		*12.7*			*12.4*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*12.7*			*12.4*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*13th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* North/South Street: *26th Street South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*8*	*401*	*6*	*33*	*169*	*22*
Peak-Hour Factor, PHF	*0.50*	*0.78*	*0.75*	*0.55*	*0.94*	*0.69*
Hourly Flow Rate, HFR (veh/h)	*16*	*514*	*8*	*59*	*179*	*31*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*26*	*1*	*10*	*1*	*1*	*6*
Peak-Hour Factor, PHF	*0.72*	*0.25*	*0.83*	*0.25*	*0.25*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*36*	*4*	*12*	*4*	*4*	*12*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*16*	*59*		*20*			*52*	
C (m) (veh/h)	*1359*	*1055*		*433*			*371*	
v/c	*0.01*	*0.06*		*0.05*			*0.14*	
95% queue length	*0.04*	*0.18*		*0.14*			*0.48*	
Control Delay (s/veh)	*7.7*	*8.6*		*13.7*			*16.3*	
LOS	*A*	*A*		*B*			*C*	
Approach Delay (s/veh)	--	--	*13.7*			*16.3*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*15th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *15th Avenue South* North/South Street: *26th Street South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*155*	*18*	*71*	*196*	*19*
Peak-Hour Factor, PHF	*0.42*	*0.84*	*0.50*	*0.71*	*0.78*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*23*	*184*	*36*	*100*	*251*	*27*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*23*	*29*	*4*	*23*	*30*
Peak-Hour Factor, PHF	*0.75*	*0.52*	*0.66*	*0.50*	*0.48*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*8*	*44*	*43*	*8*	*47*	*40*
Percent Heavy Vehicles	*0*	*0*	*3*	*0*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*23*	*100*		*95*			*95*	
C (m) (veh/h)	*1268*	*1357*		*432*			*431*	
v/c	*0.02*	*0.07*		*0.22*			*0.22*	
95% queue length	*0.06*	*0.24*		*0.83*			*0.83*	
Control Delay (s/veh)	*7.9*	*7.9*		*15.7*			*15.7*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*15.7*			*15.7*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*15th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *15th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*24*	*277*	*17*	*23*	*123*	*12*
Peak-Hour Factor, PHF	*0.50*	*0.82*	*0.60*	*0.64*	*0.83*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*48*	*337*	*28*	*35*	*148*	*16*
Percent Heavy Vehicles	*0*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*22*	*24*	*29*	*29*	*35*	*98*
Peak-Hour Factor, PHF	*0.79*	*0.50*	*0.81*	*0.73*	*0.73*	*0.70*
Hourly Flow Rate, HFR (veh/h)	*27*	*48*	*35*	*39*	*47*	*140*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*48*	*35*		*226*			*110*	
C (m) (veh/h)	*1417*	*1170*		*531*			*421*	
v/c	*0.03*	*0.03*		*0.43*			*0.26*	
95% queue length	*0.11*	*0.09*		*2.11*			*1.03*	
Control Delay (s/veh)	*7.6*	*8.2*		*16.7*			*16.5*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*16.7*			*16.5*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*10th Ave. S / 29th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *10th Avenue South* | North/South Street: *29th Street South*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*11*	*637*	*140*	*97*	*954*	*6*
Peak-Hour Factor, PHF	*0.55*	*0.85*	*0.61*	*0.71*	*0.79*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*19*	*749*	*229*	*136*	*1207*	*12*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*1*	*24*	*3*	*3*	*17*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.67*	*0.75*	*0.38*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*7*	*4*	*35*	*4*	*7*	*23*
Percent Heavy Vehicles	*0*	*0*	*1*	*0*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*19*	*136*		*46*			*34*	
C (m) (veh/h)	*567*	*701*		*106*			*70*	
v/c	*0.03*	*0.19*		*0.43*			*0.49*	
95% queue length	*0.10*	*0.71*		*1.85*			*1.97*	
Control Delay (s/veh)	*11.6*	*11.4*		*62.8*			*97.7*	
LOS	*B*	*B*		*F*			*F*	
Approach Delay (s/veh)	--	--	*62.8*			*97.7*		
Approach LOS	--	--	*F*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*10th Ave. S / 29th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *10th Avenue South* | North/South Street: *29th Street South*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*54*	*1307*	*39*	*25*	*1183*	*15*
Peak-Hour Factor, PHF	*0.68*	*0.98*	*0.75*	*0.63*	*0.95*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*79*	*1333*	*52*	*39*	*1245*	*20*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*77*	*0*	*0*	*20*
Peak-Hour Factor, PHF	*0.42*	*0.25*	*0.88*	*0.25*	*0.25*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*11*	*0*	*87*	*0*	*0*	*28*
Percent Heavy Vehicles	*0*	*0*	*1*	*0*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*79*	*39*		*98*			*28*	
C (m) (veh/h)	*545*	*490*		*131*			*476*	
v/c	*0.14*	*0.08*		*0.75*			*0.06*	
95% queue length	*0.50*	*0.26*		*4.34*			*0.19*	
Control Delay (s/veh)	*12.7*	*13.0*		*87.4*			*13.0*	
LOS	*B*	*B*		*F*			*B*	
Approach Delay (s/veh)	--	--	*87.4*			*13.0*		
Approach LOS	--	--	*F*			*B*		

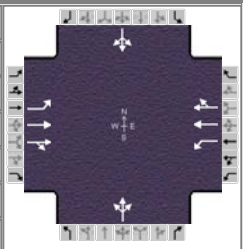
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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	7/30/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.83
Intersection	10th Ave. S / 32nd St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10_10thAveS_32ndStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	18	573	32	23	790	3	125	19	17	28	34	74

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.0	1.0	50.0	17.0	0.0	0.0	5	6	7	8
Yellow	3.6	0.0	3.6	3.0	0.0	0.0				
Red	1.4	0.0	2.4	3.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	4.0	1.1	4.0		8.0		8.0
Phase Duration, s	11.0	57.0	10.0	56.0		23.0		23.0
Change Period, *(Y+Rc)*, s	5.0	6.0	5.0	6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	2.6	0.0	2.6	0.0		2.8		2.8
Queue Clearance Time (g_s), s	2.4		2.6			19.0		11.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.3
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.11		1.00			1.00		0.06

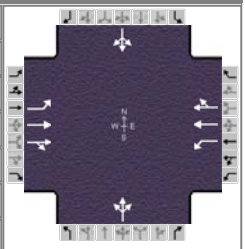
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	22	368	361	28	478	477		194			164	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1650	1619	1619	1650	1648		986			1520	
Queue Service Time (g_s), s	0.4	11.2	11.2	0.6	16.3	16.3		8.0			0.0	
Cycle Queue Clearance Time (g_c), s	0.4	11.2	11.2	0.6	16.3	16.3		17.0			9.0	
Capacity *(c)*, veh/h	411	935	918	496	917	916		257			335	
Volume-to-Capacity Ratio *(X)*	0.053	0.393	0.394	0.056	0.521	0.521		0.754			0.489	
Available Capacity (c_a), veh/h	411	935	918	496	917	916		257			335	
Back of Queue *(Q)*, veh/ln (50th percentile)	0.1	4.0	3.9	0.2	5.9	5.9		4.9			3.2	
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	7.9	10.9	10.9	7.5	12.5	12.5		38.1			33.3	
Incremental Delay (d_2), s/veh	0.0	1.2	1.3	0.0	2.1	2.1		10.7			0.4	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay *(d)*, s/veh	7.9	12.1	12.1	7.5	14.6	14.6		48.7			33.7	
Level of Service (LOS)	A	B	B	A	B	B		D			C	
Approach Delay, s/veh / LOS	12.0	B		14.4	B		48.7	D		33.7	C	
Intersection Delay, s/veh / LOS	18.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.1	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.1	A	1.3	A	0.8	A	0.8	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	7/30/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.83
Intersection	10th Ave. S / 32nd St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10_10thAveS_32ndStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	79	1174	24	51	993	9	103	63	64	51	50	65

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.0	52.0	21.0	0.0	0.0	0.0	5	6	7	8
Yellow	3.6	3.6	3.0	0.0	0.0	0.0				
Red	1.4	2.4	3.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	4.0	1.1	4.0		8.0		8.0
Phase Duration, s	10.0	58.0	10.0	58.0		27.0		27.0
Change Period, *(Y+Rc)*, s	5.0	6.0	5.0	6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	4.1	0.0	4.1	0.0		4.3		4.3
Queue Clearance Time (g_s), s	4.4		3.5			23.0		14.8
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		1.1
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		0.49

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	95	724	719	61	605	603		277			200	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1683	1669	1619	1650	1645		1150			1309	
Queue Service Time (g_s), s	2.4	32.5	32.6	1.5	24.9	24.9		8.2			0.0	
Cycle Queue Clearance Time (g_c), s	2.4	32.5	32.6	1.5	24.9	24.9		21.0			12.8	
Capacity *(c)*, veh/h	295	921	914	238	903	901		309			339	
Volume-to-Capacity Ratio *(X)*	0.322	0.786	0.787	0.258	0.669	0.669		0.897			0.590	
Available Capacity (c_a), veh/h	295	921	914	238	903	901		309			339	
Back of Queue *(Q)*, veh/ln (50th percentile)	0.8	12.9	12.9	0.5	9.4	9.4		8.7			4.3	
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	12.2	17.1	17.1	14.6	15.4	15.4		38.5			33.5	
Incremental Delay (d_2), s/veh	0.6	6.7	6.8	0.6	3.9	3.9		26.8			2.7	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay *(d)*, s/veh	12.8	23.8	23.9	15.1	19.3	19.3		65.3			36.2	
Level of Service (LOS)	B	C	C	B	B	B		E			D	
Approach Delay, s/veh / LOS	23.2	C		19.1	B		65.3	E		36.2	D	
Intersection Delay, s/veh / LOS	25.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.1	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.8	A	1.5	A	0.9	A	0.8	A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*32nd St. S / 11th Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* North/South Street: *32nd Street South*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*16*	*38*	*2*	*2*	*145*	*109*
Peak-Hour Factor, PHF	*0.67*	*0.79*	*0.25*	*0.25*	*0.59*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*23*	*48*	*8*	*8*	*245*	*160*
Percent Heavy Vehicles	*0*	--	--	*50*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*9*	*0*	*5*	*4*	*51*
Peak-Hour Factor, PHF	*0.33*	*0.75*	*0.25*	*0.63*	*0.50*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*12*	*12*	*0*	*7*	*8*	*71*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*23*	*8*		*24*			*86*	
C (m) (veh/h)	*1157*	*1287*		*437*			*660*	
v/c	*0.02*	*0.01*		*0.05*			*0.13*	
95% queue length	*0.06*	*0.02*		*0.17*			*0.45*	
Control Delay (s/veh)	*8.2*	*7.8*		*13.7*			*11.3*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*13.7*			*11.3*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*32nd St. S / 11th Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* | North/South Street: *32nd Street South*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*74*	*146*	*10*	*2*	*87*	*90*
Peak-Hour Factor, PHF	*0.84*	*0.78*	*0.63*	*0.50*	*0.73*	*0.83*
Hourly Flow Rate, HFR (veh/h)	*88*	*187*	*15*	*4*	*119*	*108*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*12*	*1*	*16*	*12*	*51*
Peak-Hour Factor, PHF	*0.50*	*0.60*	*0.25*	*0.80*	*0.75*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*8*	*19*	*4*	*19*	*16*	*63*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*88*	*4*		*31*			*98*	
C (m) (veh/h)	*1345*	*1378*		*399*			*608*	
v/c	*0.07*	*0.00*		*0.08*			*0.16*	
95% queue length	*0.21*	*0.01*		*0.25*			*0.57*	
Control Delay (s/veh)	*7.9*	*7.6*		*14.8*			*12.1*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*14.8*			*12.1*		
Approach LOS	--	--	*B*			*B*		

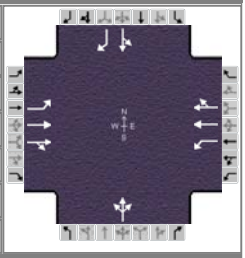
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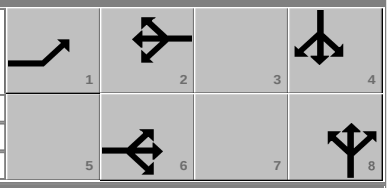
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.85
Intersection	10th Ave. S / 38th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_38thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	136	465	0	3	676	32	1	2	1	81	2	196

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	46.0	22.0	0.0	0.0	0.0
Yellow	3.6	4.3	3.0	0.0	0.0	0.0
Red	1.4	1.7	3.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		8		4
Case Number	1.0	4.0		6.3		8.0		7.0
Phase Duration, s	10.0	62.0		52.0		28.0		28.0
Change Period, *(Y+Rc)*, s	5.0	6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	4.1	0.0		0.0		4.3		4.3
Queue Clearance Time (g_s), s	6.2					2.2		15.6
Green Extension Time (g_e), s	0.0	0.0		0.0		1.2		0.7
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	1.00					0.00		0.36

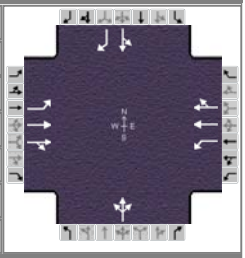
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	160	547	0	4	420	413		5			98	231
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1557	1650	0	874	1635	1608		1507			1441	1382
Queue Service Time (g_s), s	4.2	6.8	0.0	0.2	15.2	15.2		0.0			4.7	13.6
Cycle Queue Clearance Time (g_c), s	4.2	6.8	0.0	0.2	15.2	15.2		0.2			4.9	13.6
Capacity *(c)*, veh/h	387	2054		526	835	822		418			431	338
Volume-to-Capacity Ratio *(X)*	0.414	0.266	0.000	0.007	0.502	0.503		0.011			0.226	0.683
Available Capacity (c_a), veh/h	387	2054		526	835	822		418			431	338
Back of Queue *(Q)*, veh/ln (50th percentile)	1.3	2.2		0.0	5.6	5.6		0.1			1.7	4.9
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00
Uniform Delay (d_1), s/veh	10.7	7.7		10.8	14.5	14.5		25.8			27.5	30.8
Incremental Delay (d_2), s/veh	0.7	0.3	0.0	0.0	2.2	2.2		0.0			0.3	5.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Control Delay *(d)*, s/veh	11.4	8.0		10.8	16.6	16.7		25.8			27.8	36.4
Level of Service (LOS)	B	A		B	B	B		C			C	D
Approach Delay, s/veh / LOS	8.8	A		16.6	B		25.8	C		33.8	C	
Intersection Delay, s/veh / LOS	16.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.3	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.1	A	1.2	A	0.5	A	1.0	A

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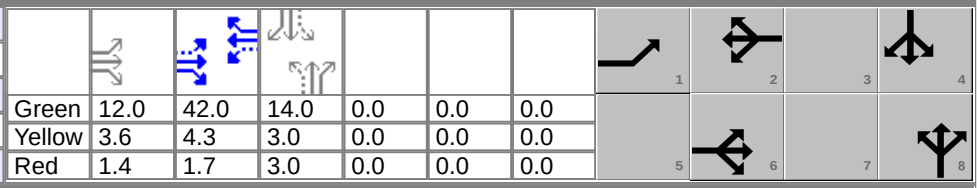
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.91
Intersection	10th Ave. S / 38th St. S	Analysis Year	2013 - Existing	Analysis Period	1> 7:00
File Name	10thAveS_38thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	250	839	1	5	935	81	4	2	3	112	5	180

Signal Information			
Cycle, s	85.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.0	42.0	14.0	0.0	0.0	0.0						
Yellow	3.6	4.3	3.0	0.0	0.0	0.0						
Red	1.4	1.7	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		8		4
Case Number	1.0	4.0		6.3		8.0		7.0
Phase Duration, s	17.0	65.0		48.0		20.0		20.0
Change Period, *(Y+Rc)*, s	5.0	6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	3.1	0.0		0.0		4.3		4.3
Queue Clearance Time *(g_s)*, s	7.9					14.6		14.9
Green Extension Time *(g_e)*, s	0.2	0.0		0.0		0.0		0.0
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	0.45					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	275	462	461	5	566	550		10			129	198
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1667	1666	615	1650	1603		423			886	1426
Queue Service Time *(g_s)*, s	5.9	10.0	10.0	0.4	22.4	22.5		0.1			0.7	11.4
Cycle Queue Clearance Time *(g_c)*, s	5.9	10.0	10.0	0.4	22.4	22.5		12.6			12.9	11.4
Capacity *(c)*, veh/h	431	1157	1156	389	816	792		131			229	235
Volume-to-Capacity Ratio *(X)*	0.637	0.399	0.399	0.014	0.694	0.695		0.076			0.562	0.842
Available Capacity *(c_a)*, veh/h	431	1157	1156	389	816	792		131			229	235
Back of Queue *(Q)*, veh/ln (50th percentile)	2.5	2.9	2.9	0.1	8.7	8.5		0.2			2.7	5.3
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00
Uniform Delay *(d_1)*, s/veh	13.2	5.5	5.5	11.0	16.6	16.6		30.4			35.2	34.4
Incremental Delay *(d_2)*, s/veh	2.4	1.0	1.0	0.1	4.8	5.0		0.2			3.1	23.2
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Control Delay *(d)*, s/veh	15.6	6.5	6.5	11.0	21.4	21.5		30.7			38.3	57.6
Level of Service (LOS)	B	A	A	B	C	C		C			D	E
Approach Delay, s/veh / LOS	8.6	A		21.4	C		30.7	C		50.0	D	
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.0	B	2.3	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.5	A	1.4	A	0.5	A	1.0	A

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*38th St. / Central Ave.*
Jurisdiction	*Great Falls*
Analysis Year	

Project ID *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Central Avenue* North/South Street: *38th Street*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*8*	*147*	*46*	*39*	*101*	*69*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*48*	*193*	*47*	*45*	*203*	*21*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*LTR*		*LTR*		*LTR*	
PHF	*0.73*		*0.68*		*0.89*		*0.81*	
Flow Rate (veh/h)	*274*		*306*		*321*		*330*	
% Heavy Vehicles	*0*		*0*		*1*		*0*	
No. Lanes	*1*		*1*		*1*		*1*	
Geometry Group	*1*		*1*		*1*		*1*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.0*		*0.2*		*0.2*		*0.2*	
Prop. Right-Turns	*0.2*		*0.3*		*0.2*		*0.1*	
Prop. Heavy Vehicle	*0.0*		*0.0*		*0.0*		*0.0*	
hLT-adj	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
hRT-adj	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*-0.1*		*-0.2*		*-0.0*		*-0.0*	

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*		*3.20*		*3.20*	
x, initial	*0.24*		*0.27*		*0.29*		*0.29*	
hd, final value (s)	*6.90*		*6.78*		*6.79*		*6.80*	
x, final value	*0.53*		*0.58*		*0.61*		*0.62*	
Move-up time, m (s)	*2.0*		*2.0*		*2.0*		*2.0*	
Service Time, t_s (s)	*4.9*		*4.8*		*4.8*		*4.8*	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*460*		*478*		*484*		*487*	
Delay (s/veh)	*17.29*		*18.61*		*19.68*		*20.40*	
LOS	*C*		*C*		*C*		*C*	
Approach: Delay (s/veh)	*17.29*		*18.61*		*19.68*		*20.40*	
LOS	*C*		*C*		*C*		*C*	
Intersection Delay (s/veh)	*19.08*							
Intersection LOS	*C*							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*38th St. / Central Ave.*
Jurisdiction	*Great Falls*
Analysis Year	

Project ID *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Central Avenue* North/South Street: *38th Street*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*18*	*77*	*7*	*28*	*50*	*27*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*39*	*300*	*22*	*21*	*319*	*30*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*LTR*		*LTR*		*LTR*	
PHF	*0.84*		*0.81*		*0.84*		*0.88*	
Flow Rate (veh/h)	*120*		*128*		*429*		*419*	
% Heavy Vehicles	*1*		*0*		*0*		*0*	
No. Lanes	*1*		*1*		*1*		*1*	
Geometry Group	*1*		*1*		*1*		*1*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.2*		*0.3*		*0.1*		*0.1*	
Prop. Right-Turns	*0.1*		*0.3*		*0.1*		*0.1*	
Prop. Heavy Vehicle	*0.0*		*0.0*		*0.0*		*0.0*	
hLT-adj	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
hRT-adj	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.0*		*-0.1*		*-0.0*		*-0.0*	

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*		*3.20*		*3.20*	
x, initial	*0.11*		*0.11*		*0.38*		*0.37*	
hd, final value (s)	*6.51*		*6.37*		*5.38*		*5.38*	
x, final value	*0.22*		*0.23*		*0.64*		*0.63*	
Move-up time, m (s)	*2.0*		*2.0*		*2.0*		*2.0*	
Service Time, t_s (s)	*4.5*		*4.4*		*3.4*		*3.4*	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*370*		*378*		*647*		*646*	
Delay (s/veh)	*11.30*		*11.23*		*17.50*		*16.94*	
LOS	*B*		*B*		*C*		*C*	
Approach: Delay (s/veh)	*11.30*		*11.23*		*17.50*		*16.94*	
LOS	*B*		*B*		*C*		*C*	
Intersection Delay (s/veh)	*15.87*							
Intersection LOS	*C*							

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Appendix C

Projected Intersection Operations

Intersection Level Of Service Report
Intersection 1: 57th St S and 2nd Ave N

Control Type:	Signalized	Delay (sec / veh):	21.6
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.312

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	0	1	0	0
Pocket Length [ft]	250.00	100.00	100.00	230.00	100.00	250.00	200.00	100.00	100.00	400.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	38	179	152	24	115	23	49	197	42	92	83	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	45	213	181	29	137	27	58	234	50	109	99	19
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9180	0.9180	0.9180	0.9640	0.9640	0.9640
Total 15-Minute Volume [veh/h]	12	56	47	8	36	7	14	58	12	29	26	5
Total Analysis Volume [veh/h]	47	223	190	30	144	28	58	233	50	114	104	20
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	2	1	6	0	3	8	0	7	4	0
Auxiliary Signal Groups			2									
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	0	5	15	0	5	15	0
Maximum Green [s]	20	45	45	20	45	0	20	45	0	20	45	0
Amber [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	12	33	33	10	31	0	15	27	0	20	32	0
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Minimum Recall	No	No	No	No	No		No	No		No	No	
Maximum Recall	No	No	No	No	No		No	No		No	No	
Pedestrian Recall	No	No	No	No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	R	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	90	90	90	90	90	90	90	90	90	90	90	90
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	53	45	45	53	45	45	27	15	15	27	18	18
g / C, Green / Cycle	0.59	0.50	0.50	0.59	0.49	0.49	0.30	0.17	0.17	0.30	0.20	0.20
(v / s)_i Volume / Saturation Flow Rate	0.04	0.14	0.14	0.03	0.06	0.06	0.05	0.09	0.10	0.10	0.04	0.04
s, saturation flow rate [veh/h]	1139	1550	1318	1089	1550	1465	1226	1550	1458	1168	1550	1466
c, Capacity [veh/h]	745	779	662	661	765	723	446	259	244	381	313	296
d1, Uniform Delay [s]	7.96	13.05	13.05	8.17	12.27	12.30	22.99	34.48	34.57	24.25	29.93	29.97
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.16	0.92	1.09	0.03	0.30	0.33	0.13	1.85	2.09	0.44	0.31	0.34
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.06	0.29	0.29	0.05	0.11	0.12	0.13	0.56	0.57	0.30	0.20	0.21
d, Delay for Lane Group [s/veh]	8.12	13.97	14.15	8.20	12.57	12.63	23.12	36.33	36.66	24.68	30.24	30.31
Lane Group LOS	A	B	B	A	B	B	C	D	D	C	C	C
Critical Lane Group	No	No	Yes	Yes	No	No	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.39	2.69	2.32	0.23	0.96	0.95	0.90	2.99	2.90	1.85	1.15	1.12
50th-Percentile Queue Length [ft/ln]	9.83	67.17	58.00	5.80	24.10	23.74	22.49	74.68	72.53	46.34	28.63	28.02
95th-Percentile Queue Length [veh/ln]	0.71	4.84	4.18	0.42	1.74	1.71	1.62	5.38	5.22	3.34	2.06	2.02
95th-Percentile Queue Length [ft/ln]	17.70	120.90	104.41	10.44	43.38	42.73	40.48	134.42	130.55	83.41	51.54	50.44

Movement, Approach, & Intersection Results

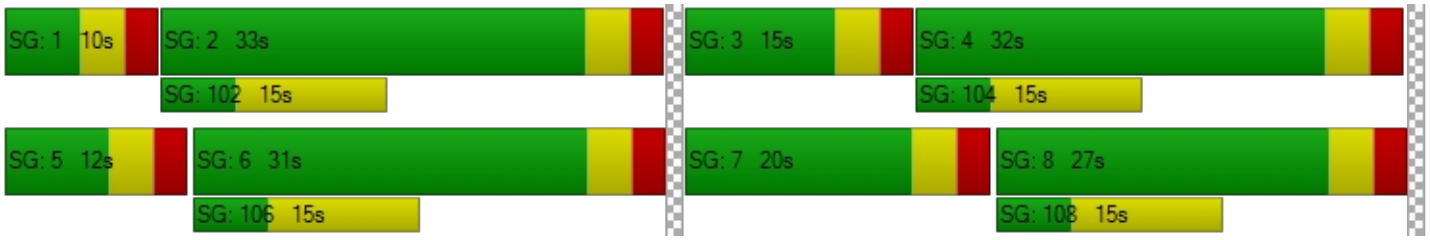
d_M, Delay for Movement [s/veh]	8.12	13.97	14.15	8.20	12.59	12.63	23.12	36.46	36.66	24.68	30.27	30.31
Movement LOS	A	B	B	A	B	B	C	D	D	C	C	C
d_A, Approach Delay [s/veh]	13.45			11.95			34.22			27.60		
Approach LOS	B			B			C			C		
d_I, Intersection Delay [s/veh]	21.62											
Intersection LOS	C											
Intersection V/C	0.312											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	36.45	36.45	36.45	36.45
l_p,int, Pedestrian LOS Score for Intersection	2.573	2.274	2.437	2.459
Crosswalk LOS	B	B	B	B
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	622	578	489	600
d_b, Bicycle Delay [s]	21.36	22.76	25.69	22.05
l_b,int, Bicycle LOS Score for Intersection	2.319	1.726	1.841	1.756
Bicycle LOS	B	A	A	A

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: 57th St S and 2nd Ave N

Control Type:	Signalized	Delay (sec / veh):	22.3
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.363

Intersection Setup

Name											
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	0	1	0	0
Pocket Length [ft]	250.00	100.00	100.00	230.00	100.00	250.00	200.00	100.00	100.00	400.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	54	158	115	19	226	69	24	82	52	224	274	57
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	64	188	137	23	269	82	29	98	62	267	326	68
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9180	0.9180	0.9180	0.9640	0.9640	0.9640
Total 15-Minute Volume [veh/h]	17	49	36	6	70	21	7	24	15	70	85	18
Total Analysis Volume [veh/h]	67	197	144	24	282	86	29	98	62	280	342	71
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	2	1	6	0	3	8	0	7	4	0
Auxiliary Signal Groups			2									
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	0	5	15	0	5	15	0
Maximum Green [s]	20	45	45	20	45	0	20	45	0	20	45	0
Amber [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	10	21	21	10	21	0	11	23	0	36	48	0
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0	3.0	0.0
Minimum Recall	No	No	No	No	No		No	No		No	No	
Maximum Recall	No	No	No	No	No		No	No		No	No	
Pedestrian Recall	No	No	No	No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	R	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	90	90	90	90	90	90	90	90	90	90	90	90
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	45	38	38	45	36	36	35	15	15	35	28	28
g / C, Green / Cycle	0.50	0.42	0.42	0.50	0.40	0.40	0.39	0.16	0.16	0.39	0.31	0.31
(v / s)_i Volume / Saturation Flow Rate	0.07	0.13	0.11	0.02	0.12	0.13	0.03	0.05	0.06	0.22	0.14	0.14
s, saturation flow rate [veh/h]	1002	1550	1318	1116	1550	1429	972	1550	1360	1299	1550	1459
c, Capacity [veh/h]	529	644	548	572	614	566	399	255	224	569	476	448
d1, Uniform Delay [s]	12.34	17.64	17.29	11.96	18.75	18.83	17.56	33.24	33.40	20.72	25.12	25.14
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.49	1.22	1.17	0.03	1.30	1.47	0.08	0.72	0.93	0.66	0.66	0.70
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.13	0.31	0.26	0.04	0.31	0.32	0.07	0.32	0.35	0.49	0.45	0.45
d, Delay for Lane Group [s/veh]	12.83	18.87	18.46	11.99	20.05	20.29	17.64	33.95	34.33	21.38	25.78	25.84
Lane Group LOS	B	B	B	B	C	C	B	C	C	C	C	C
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.75	2.86	2.07	0.24	2.85	2.73	0.37	1.61	1.55	4.37	3.65	3.46
50th-Percentile Queue Length [ft/ln]	18.81	71.58	51.79	6.03	71.23	68.31	9.35	40.28	38.80	109.34	91.17	86.43
95th-Percentile Queue Length [veh/ln]	1.35	5.15	3.73	0.43	5.13	4.92	0.67	2.90	2.79	7.80	6.56	6.22
95th-Percentile Queue Length [ft/ln]	33.85	128.85	93.23	10.85	128.21	122.95	16.83	72.50	69.84	195.09	164.10	155.58

Movement, Approach, & Intersection Results

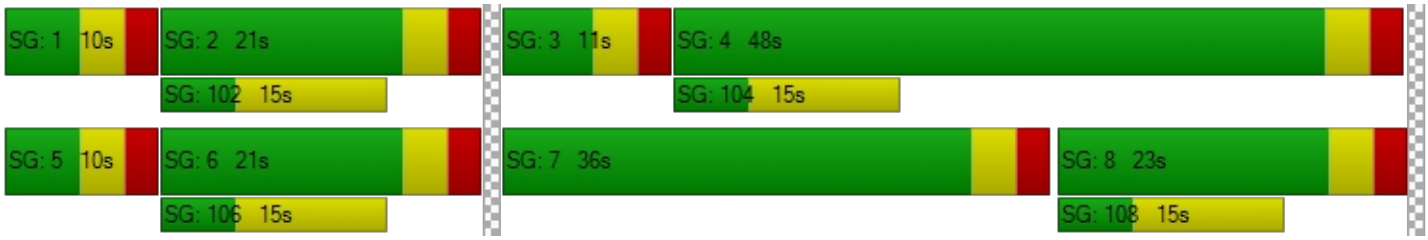
d_M, Delay for Movement [s/veh]	12.83	18.87	18.46	11.99	20.13	20.29	17.64	34.02	34.33	21.38	25.80	25.84
Movement LOS	B	B	B	B	C	C	B	C	C	C	C	C
d_A, Approach Delay [s/veh]	17.73			19.67			31.60			24.02		
Approach LOS	B			B			C			C		
d_I, Intersection Delay [s/veh]	22.33											
Intersection LOS	C											
Intersection V/C	0.363											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	36.45	36.45	36.45	36.45
l_p,int, Pedestrian LOS Score for Intersection	2.632	2.314	2.475	2.503
Crosswalk LOS	B	B	B	B
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	356	356	400	956
d_b, Bicycle Delay [s]	30.42	30.42	28.80	12.27
l_b,int, Bicycle LOS Score for Intersection	2.233	1.883	1.716	2.131
Bicycle LOS	B	A	A	B

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: 10th Ave S and 20th St S

Control Type:	Signalized	Delay (sec / veh):	13.8
Analysis Method:	HCM 6th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.439

Intersection Setup

Name											
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	275.00	100.00	100.00	275.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	57	40	48	51	64	31	12	1226	153	31	1159	38
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	3.60	7.50	4.20	2.00	1.60	3.20	0.00	4.70	2.70	3.20	2.60	2.60
Growth Rate	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	60	42	50	54	67	33	13	1287	161	33	1217	40
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	0.8550	0.8550	0.8550	0.8550	0.8550	0.8550	0.8660	0.8660	0.8660	0.8660	0.8660	0.8660
Total 15-Minute Volume [veh/h]	14	10	12	13	16	8	3	303	38	8	286	9
Total Analysis Volume [veh/h]	56	39	46	50	62	31	12	1211	152	31	1146	38
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	130
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	2	0	0	6	0	0	8	0	0	4	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	30	0	0	30	0	0	60	0	0	60	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	36	0	0	36	0	0	94	0	0	94	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	130	130	130	130	130	130	130	130	130
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	31	31	31	89	89	89	89	89	89
g / C, Green / Cycle	0.24	0.24	0.24	0.68	0.68	0.68	0.68	0.68	0.68
(v / s)_i Volume / Saturation Flow Rate	0.05	0.06	0.12	0.03	0.32	0.32	0.09	0.27	0.27
s, saturation flow rate [veh/h]	1158	1353	1157	433	2887	1432	356	2937	1517
c, Capacity [veh/h]	164	323	313	296	1977	980	242	2011	1039
d1, Uniform Delay [s]	43.02	40.22	44.68	13.24	9.45	9.45	16.15	8.81	8.81
k, delay calibration	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	5.54	1.99	4.73	0.26	0.78	1.56	1.09	0.57	1.10
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.34	0.26	0.46	0.04	0.46	0.46	0.13	0.39	0.39
d, Delay for Lane Group [s/veh]	48.56	42.21	49.41	13.50	10.22	11.01	17.24	9.37	9.90
Lane Group LOS	D	D	D	B	B	B	B	A	A
Critical Lane Group	No	No	Yes	No	No	Yes	No	No	No
50th-Percentile Queue Length [veh/ln]	1.83	2.41	4.55	0.18	5.87	6.04	0.56	4.68	4.99
50th-Percentile Queue Length [ft/ln]	45.66	60.26	113.71	4.60	146.85	150.99	13.99	116.97	124.75
95th-Percentile Queue Length [veh/ln]	3.29	4.34	8.05	0.33	9.85	10.07	1.01	8.23	8.65
95th-Percentile Queue Length [ft/ln]	82.19	108.47	201.15	8.27	246.22	251.75	25.17	205.66	216.34

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	48.56	42.21	42.21	49.41	49.41	49.41	13.50	10.42	11.01	17.24	9.54	9.90
Movement LOS	D	D	D	D	D	D	B	B	B	B	A	A
d_A, Approach Delay [s/veh]	44.73			49.41			10.51			9.75		
Approach LOS	D			D			B			A		
d_I, Intersection Delay [s/veh]	13.80											
Intersection LOS	B											
Intersection V/C	0.439											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	56.31	56.31	56.31	56.31
l_p,int, Pedestrian LOS Score for Intersection	2.129	1.864	3.056	3.035
Crosswalk LOS	B	A	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	477	477	1369	1369
d_b, Bicycle Delay [s]	37.70	37.70	6.47	6.47
l_b,int, Bicycle LOS Score for Intersection	1.792	1.796	2.316	2.228
Bicycle LOS	A	A	B	B

Sequence

Ring 1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: 10th Ave S and 20th St S

Control Type:	Signalized	Delay (sec / veh):	27.5
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.582

Intersection Setup

Name											
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	275.00	100.00	100.00	275.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	227	62	90	52	65	42	17	1449	114	36	1764	27
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.40	0.00	1.10	0.00	0.00	2.40	0.00	1.90	0.00	0.00	1.90	0.00
Growth Rate	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	238	65	95	55	68	44	18	1521	120	38	1852	28
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	0.8550	0.8550	0.8550	0.8550	0.8550	0.8550	0.8660	0.8660	0.8660	0.8660	0.8660	0.8660
Total 15-Minute Volume [veh/h]	55	15	22	13	16	10	4	358	28	9	436	7
Total Analysis Volume [veh/h]	221	60	88	51	63	41	17	1432	113	36	1743	26
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	135
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	2	0	0	6	0	0	8	0	0	4	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	30	0	0	30	0	0	60	0	0	60	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	56	0	0	56	0	0	79	0	0	79	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	10	0	0	10	0	0	10	0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	C
C, Cycle Length [s]	135	135	135	135	135	135	135	135	135
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	51	51	51	74	74	74	74	74	74
g / C, Green / Cycle	0.38	0.38	0.38	0.55	0.55	0.55	0.55	0.55	0.55
(v / s)_i Volume / Saturation Flow Rate	0.19	0.10	0.13	0.07	0.35	0.35	0.12	0.39	0.39
s, saturation flow rate [veh/h]	1176	1425	1153	247	2954	1494	306	2954	1540
c, Capacity [veh/h]	314	538	471	112	1619	819	143	1619	844
d1, Uniform Delay [s]	41.24	29.16	32.63	41.89	21.12	21.12	38.26	22.73	22.73
k, delay calibration	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	12.46	1.26	1.86	2.83	1.90	3.72	4.18	2.77	5.23
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.70	0.27	0.33	0.15	0.63	0.63	0.25	0.72	0.72
d, Delay for Lane Group [s/veh]	53.70	30.42	34.49	44.72	23.02	24.84	42.44	25.50	27.96
Lane Group LOS	D	C	C	D	C	C	D	C	C
Critical Lane Group	Yes	No	No	No	No	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	7.66	3.57	4.18	0.56	11.48	12.03	1.13	14.10	15.29
50th-Percentile Queue Length [ft/ln]	191.61	89.15	104.40	13.91	286.98	300.71	28.26	352.57	382.20
95th-Percentile Queue Length [veh/ln]	12.20	6.42	7.52	1.00	17.04	17.72	2.03	20.26	21.70
95th-Percentile Queue Length [ft/ln]	305.12	160.46	187.93	25.03	425.89	442.91	50.86	506.54	542.50

Movement, Approach, & Intersection Results

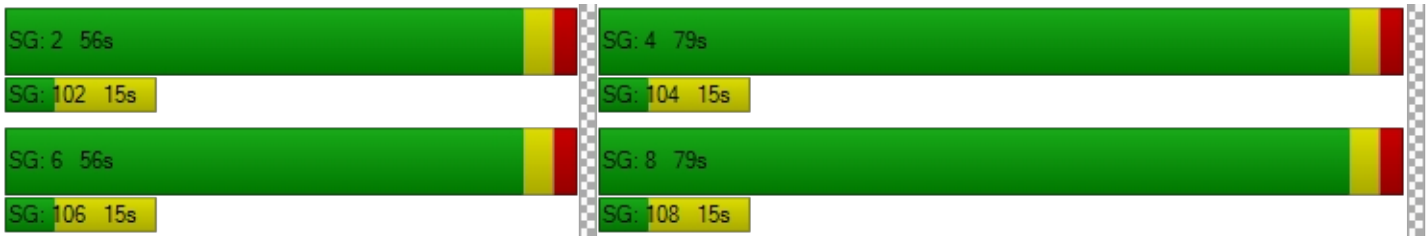
d_M, Delay for Movement [s/veh]	53.70	30.42	30.42	34.49	34.49	34.49	44.72	23.53	24.84	42.44	26.32	27.96
Movement LOS	D	C	C	C	C	C	D	C	C	D	C	C
d_A, Approach Delay [s/veh]	44.36			34.49			23.86			26.66		
Approach LOS	D			C			C			C		
d_I, Intersection Delay [s/veh]	27.53											
Intersection LOS	C											
Intersection V/C	0.582											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	58.80	58.80	58.80	58.80
l_p,int, Pedestrian LOS Score for Intersection	2.201	1.886	3.426	3.157
Crosswalk LOS	B	A	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	756	756	1096	1096
d_b, Bicycle Delay [s]	26.13	26.13	13.78	13.78
l_b,int, Bicycle LOS Score for Intersection	2.168	1.815	2.419	2.552
Bicycle LOS	B	A	B	B

Sequence

Ring 1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 3: 10th Ave S and 6th St SW/Fox Farm Rd

Control Type:	Signalized	Delay (sec / veh):	45.6
Analysis Method:	HCM 6th Edition	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	7.072

Intersection Setup

Name											
Approach	Northbound			Southbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	1	2	0	1
Pocket Length [ft]	150.00	100.00	100.00	500.00	100.00	300.00	300.00	100.00	300.00	525.00	100.00	500.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	159	98	136	47	191	421	133	395	130	157	740	48
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.40	3.06	5.88	4.26	1.05	0.48	1.50	4.30	2.31	3.82	5.14	6.25
Growth Rate	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	186	115	159	55	223	493	156	462	152	184	866	56
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	0.8670	0.8670	0.8670	0.8750	0.8750	0.8750	0.8890	0.8890	0.8890	0.8750	0.8750	0.8750
Total 15-Minute Volume [veh/h]	44	27	37	13	53	117	38	112	37	44	206	13
Total Analysis Volume [veh/h]	175	108	150	52	212	469	151	446	147	175	824	53
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	135
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap
Signal group	5	2	2	1	6	6	3	8	8	7	4	4
Auxiliary Signal Groups			2			6			8			4
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	15	5	15	15	5	15	15
Maximum Green [s]	15	60	60	20	60	60	20	60	60	20	60	60
Amber [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All red [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Split [s]	10	53	53	10	53	53	21	20	20	52	51	51
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Walk [s]	0	5	5	0	5	5	0	5	5	0	5	5
Pedestrian Clearance [s]	0	10	10	0	10	10	0	10	10	0	10	10
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Recall	Yes	No	No	No	No	No	No	No	No	No	No	No
Maximum Recall	No	No	No	No	No	No	No	No	No	No	No	No
Pedestrian Recall	No	No	No	No	No	No	No	No	No	No	No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	C	R	L	C	R	L	C	R	L	C	R
C, Cycle Length [s]	135	135	135	135	135	135	135	135	135	135	135	135
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	63	53	53	63	53	53	16	46	46	11	41	41
g / C, Green / Cycle	0.47	0.39	0.39	0.47	0.39	0.39	0.12	0.34	0.34	0.08	0.31	0.31
(v / s)_i Volume / Saturation Flow Rate	0.22	0.08	0.12	0.05	0.07	0.35	0.10	0.15	0.11	0.06	0.29	0.04
s, saturation flow rate [veh/h]	801	1399	1277	1136	2974	1334	1482	2897	1314	2825	2877	1273
c, Capacity [veh/h]	480	550	502	509	1169	524	171	991	449	225	881	390
d1, Uniform Delay [s]	27.30	26.99	28.22	23.90	26.80	38.40	58.88	34.59	32.95	61.03	45.59	33.95
k, delay calibration	0.50	0.50	0.50	0.11	0.50	0.50	0.19	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	2.13	0.80	1.52	0.09	0.34	20.38	20.96	0.32	0.42	5.71	5.39	0.16
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.36	0.20	0.30	0.10	0.18	0.89	0.88	0.45	0.33	0.78	0.94	0.14
d, Delay for Lane Group [s/veh]	29.43	27.79	29.74	23.98	27.15	58.77	79.84	34.91	33.37	66.74	50.98	34.11
Lane Group LOS	C	C	C	C	C	E	E	C	C	E	D	C
Critical Lane Group	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh/ln]	2.33	2.45	3.59	1.05	2.32	17.34	6.09	5.80	3.66	3.13	14.03	1.30
50th-Percentile Queue Length [ft/ln]	58.26	61.19	89.74	26.26	58.07	433.46	152.33	144.89	91.60	78.29	350.83	32.45
95th-Percentile Queue Length [veh/ln]	4.19	4.41	6.46	1.89	4.18	24.17	10.14	9.74	6.60	5.64	20.18	2.34
95th-Percentile Queue Length [ft/ln]	104.87	110.13	161.52	47.28	104.53	604.18	253.54	243.59	164.88	140.93	504.42	58.41

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	29.43	27.79	29.74	23.98	27.15	58.77	79.84	34.91	33.37	66.74	50.98	34.11
Movement LOS	C	C	C	C	C	E	E	C	C	E	D	C
d_A, Approach Delay [s/veh]	29.13			47.16			43.72			52.75		
Approach LOS	C			D			D			D		
d_I, Intersection Delay [s/veh]	45.65											
Intersection LOS	D											
Intersection V/C	7.072											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	58.80	58.80	58.80	58.80
l_p,int, Pedestrian LOS Score for Intersection	2.509	2.643	3.082	2.956
Crosswalk LOS	B	B	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	711	711	222	681
d_b, Bicycle Delay [s]	28.03	28.03	53.33	29.34
l_b,int, Bicycle LOS Score for Intersection	1.917	2.164	2.173	2.428
Bicycle LOS	A	B	B	B

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 3: 10th Ave S and 6th St SW/Fox Farm Rd

Control Type:	Signalized	Delay (sec / veh):	80.4
Analysis Method:	HCM 6th Edition	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	469.735

Intersection Setup

Name											
Approach	Northbound			Southbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	1	0	1	2	0	1
Pocket Length [ft]	150.00	100.00	100.00	500.00	100.00	300.00	300.00	100.00	300.00	525.00	100.00	500.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name												
Base Volume Input [veh/h]	177	307	348	75	175	246	508	959	232	222	679	92
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.56	1.30	1.15	4.00	0.57	0.00	0.20	2.61	2.16	1.35	3.53	0.00
Growth Rate	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	207	359	407	88	205	288	594	1122	271	260	794	108
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	0.8670	0.8670	0.8670	0.8750	0.8750	0.8750	0.8890	0.8890	0.8890	0.8750	0.8750	0.8750
Total 15-Minute Volume [veh/h]	49	85	96	21	49	68	143	271	65	62	189	26
Total Analysis Volume [veh/h]	195	338	384	84	195	274	574	1084	262	247	755	103
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	135
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap	Protecte	Permiss	Overlap
Signal group	5	2	2	1	6	6	3	8	8	7	4	4
Auxiliary Signal Groups			2			6			8			4
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	15	5	15	15	5	15	15	5	15	15
Maximum Green [s]	15	60	60	20	60	60	20	60	60	20	60	60
Amber [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All red [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Split [s]	10	39	39	11	40	40	50	66	66	19	35	35
Vehicle Extension [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Walk [s]	0	5	5	0	5	5	0	5	5	0	5	5
Pedestrian Clearance [s]	0	10	10	0	10	10	0	10	10	0	10	10
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
I2, Clearance Lost Time [s]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Recall	Yes	No	No	No	No	No	No	No	No	No	No	No
Maximum Recall	No	No	No	No	No	No	No	No	No	No	No	No
Pedestrian Recall	No	No	No	No	No	No	No	No	No	No	No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	C	R	L	C	R	L	C	R	L	C	R
C, Cycle Length [s]	135	135	135	135	135	135	135	135	135	135	135	135
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	45	34	34	45	35	35	45	62	62	13	30	30
g / C, Green / Cycle	0.33	0.25	0.25	0.33	0.26	0.26	0.33	0.46	0.46	0.10	0.22	0.22
(v / s)_i Volume / Saturation Flow Rate	0.29	0.24	0.29	0.09	0.07	0.20	0.38	0.37	0.20	0.09	0.26	0.08
s, saturation flow rate [veh/h]	692	1419	1327	923	2985	1339	1498	2937	1316	2882	2915	1339
c, Capacity [veh/h]	335	355	332	143	770	345	499	1343	602	287	652	299
d1, Uniform Delay [s]	44.14	49.57	50.59	43.01	39.76	46.73	45.01	31.52	24.83	59.86	52.40	44.07
k, delay calibration	0.50	0.50	0.50	0.13	0.50	0.50	0.50	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	7.57	34.44	98.41	4.73	0.79	16.92	88.73	1.20	0.50	7.49	75.23	0.68
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.59	0.94	1.16	0.59	0.25	0.79	1.15	0.81	0.44	0.86	1.16	0.34
d, Delay for Lane Group [s/veh]	51.71	84.00	149.00	47.74	40.55	63.65	133.74	32.71	25.32	67.35	127.63	44.75
Lane Group LOS	D	F	F	D	D	E	F	C	C	E	F	D
Critical Lane Group	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh/ln]	4.79	14.39	20.27	2.29	2.68	10.21	28.85	15.25	5.80	4.47	17.84	2.99
50th-Percentile Queue Length [ft/ln]	119.76	359.79	506.63	57.25	67.10	255.22	721.21	381.19	145.11	111.75	445.90	74.65
95th-Percentile Queue Length [veh/ln]	8.38	20.61	29.96	4.12	4.83	15.45	41.18	21.65	9.76	7.94	26.75	5.37
95th-Percentile Queue Length [ft/ln]	209.50	515.33	749.07	103.05	120.79	386.23	1029.51	541.29	243.89	198.43	668.79	134.37

Movement, Approach, & Intersection Results

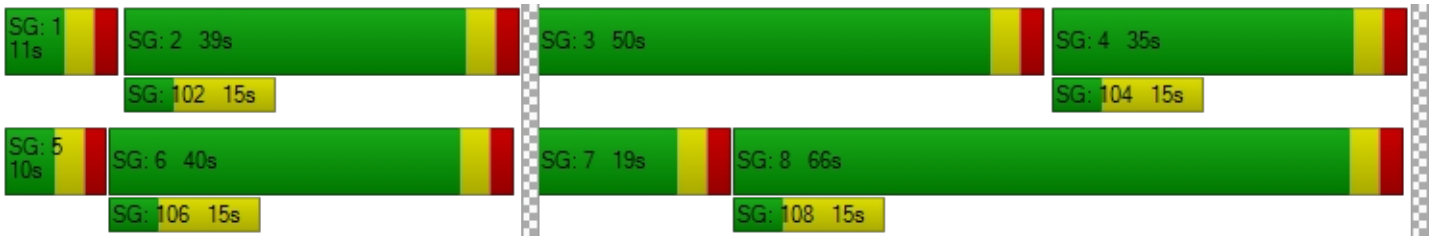
d_M, Delay for Movement [s/veh]	51.71	83.58	149.00	47.74	40.55	63.65	133.74	32.71	25.32	67.35	127.63	44.75
Movement LOS	D	F	F	D	D	E	F	C	C	E	F	D
d_A, Approach Delay [s/veh]	104.20			53.09			61.91			106.43		
Approach LOS	F			D			E			F		
d_I, Intersection Delay [s/veh]	80.40											
Intersection LOS	F											
Intersection V/C	469.735											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	58.80	58.80	58.80	58.80
l_p,int, Pedestrian LOS Score for Intersection	2.637	2.728	3.268	3.043
Crosswalk LOS	B	B	C	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	504	519	904	444
d_b, Bicycle Delay [s]	37.78	37.04	20.28	40.83
l_b,int, Bicycle LOS Score for Intersection	2.316	2.016	3.144	2.471
Bicycle LOS	B	B	C	B

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#11: Vaughn Rd and I-15 SB

Control Type:	Two-way stop	Delay (sec / veh):	11.0
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.361

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	219	1	0	27	12	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.60	0.00	2.00	11.10	8.30	2.00
Growth Rate	1.36	1.36	1.00	1.36	1.36	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	298	1	0	37	16	0
Peak Hour Factor	0.8830	0.2500	1.0000	0.8440	0.7500	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	84	1	0	11	5	0
Total Analysis Volume [veh/h]	337	4	0	44	21	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.36	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	11.04	10.58	0.00	0.00	0.00	0.00
Movement LOS	B	B		A	A	
95th-Percentile Queue Length [veh]	1.68	1.68	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	42.07	42.07	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	11.04		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	9.27					
Intersection LOS	B					

Intersection Level Of Service Report
#11: Vaughn Rd and I-15 SB

Control Type:	Two-way stop	Delay (sec / veh):	11.0
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.254

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	143	1	0	53	50	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	7.00	0.00	2.00	7.60	4.00	2.00
Growth Rate	1.36	1.36	1.00	1.36	1.36	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	194	1	0	72	68	0
Peak Hour Factor	0.9410	0.2500	1.0000	0.7790	0.8930	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	52	1	0	23	19	0
Total Analysis Volume [veh/h]	206	4	0	92	76	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.25	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.97	10.17	0.00	0.00	0.00	0.00
Movement LOS	B	B		A	A	
95th-Percentile Queue Length [veh]	1.03	1.03	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	25.74	25.74	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.96		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	6.09					
Intersection LOS	B					

Intersection Level Of Service Report
#12: Vaughn Rd and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	7.3
Analysis Method:	HCM2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.000

Intersection Setup

Name						
Approach	Eastbound		Westbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	237	19	76	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	5.00	5.30	14.50	2.00	2.00
Growth Rate	1.37	1.37	1.37	1.37	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	325	26	104	0	0
Peak Hour Factor	1.0000	0.8590	0.5940	0.8260	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	95	11	31	0	0
Total Analysis Volume [veh/h]	0	378	44	126	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Free	Free	Stop
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	7.28	0.00	0.00	0.00	0.00	0.00
Movement LOS	A	A	A	A		
95th-Percentile Queue Length [veh]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		0.00		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
#12: Vaughn Rd and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	7.4
Analysis Method:	HCM2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.000

Intersection Setup

Name						
Approach	Eastbound		Westbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	165	55	334	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	6.10	1.80	4.80	2.00	2.00
Growth Rate	1.37	1.37	1.37	1.37	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	226	75	458	0	0
Peak Hour Factor	1.0000	0.7500	0.8090	0.9180	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	75	23	125	0	0
Total Analysis Volume [veh/h]	0	301	93	499	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Free	Free	Stop
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	7.38	0.00	0.00	0.00	0.00	0.00
Movement LOS	A	A	A	A		
95th-Percentile Queue Length [veh]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		0.00		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
#8: Central Ave and I15 SB

Control Type:	Two-way stop	Delay (sec / veh):	178.9
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.188

Intersection Setup

Name												
Approach	Southbound			Eastbound			Westbound			Northwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	130	0	6	0	191	39	123	88	0	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.30	0.00	0.00	2.00	3.10	0.00	6.50	11.30	2.00	2.00	2.00	2.00
Growth Rate	1.41	1.41	1.41	1.00	1.41	1.41	1.41	1.41	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	183	0	8	0	269	55	173	124	0	0	0	0
Peak Hour Factor	0.8550	1.0000	0.7500	1.0000	0.6920	0.7500	0.7690	0.8150	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	54	0	3	0	97	18	56	38	0	0	0	0
Total Analysis Volume [veh/h]	214	0	11	0	389	73	225	152	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	1.19	0.00	0.01	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	178.88	176.96	9.05	0.00	0.00	0.00	8.91	0.00	0.00	0.00	0.00	0.00
Movement LOS	F	F	A		A	A	A	A				
95th-Percentile Queue Length [veh]	11.32	11.32	0.04	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	282.97	282.97	0.93	0.00	0.00	0.00	18.22	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	170.57			0.00			5.32			0.00		
Approach LOS	F			A			A			A		
d_I, Intersection Delay [s/veh]	37.95											
Intersection LOS	F											

Intersection Level Of Service Report
#8: Central Ave and I15 SB

Control Type:	Two-way stop	Delay (sec / veh):	314.9
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.339

Intersection Setup

Name												
Approach	Southbound			Eastbound			Westbound			Northwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	66	0	6	0	166	30	230	299	0	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	6.00	0.00	0.00	2.00	0.60	0.00	6.50	1.00	2.00	2.00	2.00	2.00
Growth Rate	1.41	1.41	1.41	1.00	1.41	1.41	1.41	1.41	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	93	0	8	0	234	42	324	422	0	0	0	0
Peak Hour Factor	0.9170	1.0000	0.7500	1.0000	0.8470	0.8330	0.8980	0.8690	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	25	0	3	0	69	13	90	121	0	0	0	0
Total Analysis Volume [veh/h]	101	0	11	0	276	50	361	486	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	1.34	0.00	0.02	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	314.89	307.18	11.27	0.00	0.00	0.00	8.99	0.00	0.00	0.00	0.00	0.00
Movement LOS	F	F	B		A	A	A	A				
95th-Percentile Queue Length [veh]	7.96	7.96	0.06	0.00	0.00	0.00	1.19	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	198.90	198.90	1.44	0.00	0.00	0.00	29.75	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	285.07			0.00			3.83			0.00		
Approach LOS	F			A			A			A		
d_I, Intersection Delay [s/veh]	27.37											
Intersection LOS	F											

Intersection Level Of Service Report
#9: Central Ave and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	113.1
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.274

Intersection Setup

Name											
Approach	Northbound			Eastbound			Westbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	15	0	177	6	305	0	0	202	44	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	10.80	16.70	2.00	2.00	2.00	11.40	13.60	2.00	2.00	2.00
Growth Rate	1.64	1.64	1.64	1.64	1.64	1.00	1.00	1.64	1.64	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	25	0	290	10	500	0	0	331	72	0	0	0
Peak Hour Factor	0.5360	1.0000	0.8510	0.7500	0.7190	1.0000	1.0000	0.8420	0.7330	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	12	0	85	3	174	0	0	98	25	0	0	0
Total Analysis Volume [veh/h]	47	0	341	13	695	0	0	393	98	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Free	Free	Stop
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.27	0.00	0.80	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	113.09	109.47	100.54	8.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Movement LOS	F	F	F	A	A			A	A			
95th-Percentile Queue Length [veh]	13.79	13.79	13.79	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	344.63	344.63	344.63	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	102.06			0.15			0.00			0.00		
Approach LOS	F			A			A			A		
d_I, Intersection Delay [s/veh]	25.02											
Intersection LOS	F											

Intersection Level Of Service Report
#9: Central Ave and I-15 NB

Control Type:	Two-way stop	Delay (sec / veh):	445.2
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.211

Intersection Setup

Name												
Approach	Northbound			Eastbound			Westbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	57	0	170	5	249	0	0	471	113	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.80	0.00	7.00	0.00	2.00	2.00	2.00	4.60	0.90	2.00	2.00	2.00
Growth Rate	1.64	1.64	1.64	1.64	1.64	1.00	1.00	1.64	1.64	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	93	0	279	8	408	0	0	772	185	0	0	0
Peak Hour Factor	0.7130	1.0000	0.7590	0.4170	0.8650	1.0000	1.0000	0.9350	0.8310	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	33	0	92	5	118	0	0	206	56	0	0	0
Total Analysis Volume [veh/h]	130	0	368	19	472	0	0	826	223	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop			Free			Free			Stop		
Flared Lane	no											
Storage Area [veh]	0			0			0			0		
Two-Stage Gap Acceptance	no											
Number of Storage Spaces in Median	0			0			0			0		

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	1.21	0.00	0.63	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	445.19	435.47	417.85	9.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Movement LOS	F	F	F	A	A			A	A			
95th-Percentile Queue Length [veh]	33.98	33.98	33.98	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	849.39	849.39	849.39	1.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	424.99			0.37			0.00			0.00		
Approach LOS	F			A			A			A		
d_I, Intersection Delay [s/veh]	103.94											
Intersection LOS	F											

Intersection Level Of Service Report
#10: Central Ave and Vaughn Rd

Control Type:	Two-way stop	Delay (sec / veh):	406.0
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.518

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	77	60	71	410	184	65
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	9.10	6.70	7.00	5.10	11.40	6.20
Growth Rate	1.63	1.63	1.63	1.63	1.63	1.63
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	126	98	116	668	300	106
Peak Hour Factor	0.7700	0.7890	0.8450	0.8010	0.8520	0.7740
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	41	31	34	208	88	34
Total Analysis Volume [veh/h]	164	124	137	834	352	137
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	1.52	0.20	0.13	0.01	0.00	0.00
d_M, Delay for Movement [s/veh]	405.95	378.42	8.95	0.00	0.00	0.00
Movement LOS	F	F	A	A	A	A
95th-Percentile Queue Length [veh]	20.34	20.34	0.45	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	508.50	508.50	11.23	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	394.10		1.26		0.00	
Approach LOS	F		A		A	
d_I, Intersection Delay [s/veh]	65.63					
Intersection LOS	F					

Intersection Level Of Service Report
#10: Central Ave and Vaughn Rd

Control Type:	Two-way stop	Delay (sec / veh):	1,422.7
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	3.231

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	68	121	66	361	462	76
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.90	1.60	1.50	4.00	3.40	2.60
Growth Rate	1.63	1.63	1.63	1.63	1.63	1.63
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	111	197	108	588	753	124
Peak Hour Factor	0.6540	0.9450	0.7500	0.7910	0.8680	0.7310
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	42	52	36	186	217	42
Total Analysis Volume [veh/h]	170	208	144	743	868	170
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	3.23	0.66	0.21	0.01	0.01	0.00
d_M, Delay for Movement [s/veh]	1422.75	1365.77	11.82	0.00	0.00	0.00
Movement LOS	F	F	B	A	A	A
95th-Percentile Queue Length [veh]	38.77	38.77	0.81	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	969.13	969.13	20.22	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	1391.39		1.92		0.00	
Approach LOS	F		A		A	
d_I, Intersection Delay [s/veh]	229.11					
Intersection LOS	F					

Intersection Level Of Service Report
#6: 14th St SW and I-315 WB

Control Type:	Signalized	Delay (sec / veh):	22.2
Analysis Method:	HCM2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.295

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	11	17	90	26	136	0	0	7	15	162	16	38
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	9.10	0.00	4.40	7.70	1.50	0.00	0.00	0.00	0.00	2.50	0.00	0.00
Growth Rate	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	13	20	104	30	158	0	0	8	17	188	19	44
Peak Hour Factor	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040	0.8040
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	4	6	32	9	49	0	0	2	5	58	6	14
Total Analysis Volume [veh/h]	16	25	129	37	197	0	0	10	21	234	24	55
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	yes
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	1	2	0	1	0	0	3	0	0	2	0
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	5	0	5	0	0	5	0	0	5	0
Maximum Green [s]	0	35	40	0	35	0	0	25	0	0	40	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	25	19	0	25	0	0	16	0	0	19	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	9	7	0	9	0	0	0	0	0	7	0
Pedestrian Clearance [s]	0	11	7	0	11	0	0	0	0	0	7	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		no	no		no			no			no	
Maximum Recall		no	no		no			no			no	
Pedestrian Recall		no	no		no			no			no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	C	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	13	13	30	13	13	2	12	12
g / C, Green / Cycle	0.21	0.21	0.49	0.21	0.21	0.03	0.20	0.20
(v / s)_i Volume / Saturation Flow Rate	0.02	0.01	0.09	0.03	0.12	0.02	0.16	0.04
s, saturation flow rate [veh/h]	994	1710	1392	1176	1685	1527	1636	1454
c, Capacity [veh/h]	183	356	686	305	350	52	329	292
d1, Uniform Delay [s]	26.76	19.09	8.52	21.98	21.31	28.58	22.73	19.90
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.20	0.08	0.13	0.18	1.41	10.57	4.12	0.31
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.09	0.07	0.19	0.12	0.56	0.60	0.78	0.19
d, Delay for Lane Group [s/veh]	26.96	19.18	8.65	22.16	22.72	39.15	26.86	20.21
Lane Group LOS	C	B	A	C	C	D	C	C
Critical Lane Group	no	no	no	no	yes	yes	yes	no
50th-Percentile Queue Length [veh]	0.22	0.27	0.82	0.44	2.44	0.57	3.57	0.62
50th-Percentile Queue Length [ft]	5.43	6.74	20.40	11.02	60.90	14.26	89.30	15.53
95th-Percentile Queue Length [veh]	0.39	0.49	1.47	0.79	4.38	1.03	6.43	1.12
95th-Percentile Queue Length [ft]	9.77	12.13	36.71	19.83	109.62	25.67	160.74	27.96

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.96	19.18	8.65	22.16	22.72	22.72	39.15	39.15	39.15	26.86	26.86	20.21
Movement LOS	C	B	A	C	C	C	D	D	D	C	C	C
d_A, Approach Delay [s/veh]	11.92			22.63			39.15			25.69		
Approach LOS	B			C			D			C		
d_I, Intersection Delay [s/veh]	22.16											
Intersection LOS	C											
Intersection V/C	0.295											

Sequence

Ring 1	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#6: 14th St SW and I-315 WB

Control Type:	Signalized	Delay (sec / veh):	19.6
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.621

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	5	76	146	22	131	2	3	5	19	638	12	142
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	40.00	6.60	0.70	0.00	2.30	0.00	0.00	0.00	15.80	1.80	8.30	4.20
Growth Rate	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	6	88	169	26	152	2	3	6	22	740	14	165
Peak Hour Factor	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880	0.9880
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	22	43	7	38	1	1	2	6	187	4	42
Total Analysis Volume [veh/h]	6	89	171	26	154	2	3	6	22	749	14	167
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	yes
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	1	2	0	1	0	0	3	0	0	2	0
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	5	0	5	0	0	5	0	0	5	0
Maximum Green [s]	0	35	40	0	35	0	0	25	0	0	40	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	25	19	0	25	0	0	16	0	0	19	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	9	7	0	9	0	0	0	0	0	7	0
Pedestrian Clearance [s]	0	11	7	0	11	0	0	0	0	0	7	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		no	no		no			no			no	
Maximum Recall		no	no		no			no			no	
Pedestrian Recall		no	no		no			no			no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	C	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	11	11	49	11	11	2	33	33
g / C, Green / Cycle	0.18	0.18	0.81	0.18	0.18	0.03	0.54	0.54
(v / s)_i Volume / Saturation Flow Rate	0.01	0.06	0.12	0.02	0.09	0.02	0.51	0.12
s, saturation flow rate [veh/h]	804	1604	1443	1196	1668	1513	1505	1395
c, Capacity [veh/h]	167	290	1168	234	301	51	820	760
d1, Uniform Delay [s]	26.79	21.32	1.24	25.10	22.21	28.59	12.61	7.06
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.27	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.09	0.59	0.06	0.21	1.37	11.05	11.60	0.14
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.04	0.31	0.15	0.11	0.52	0.61	0.93	0.22
d, Delay for Lane Group [s/veh]	26.88	21.91	1.30	25.31	23.59	39.64	24.21	7.20
Lane Group LOS	C	C	A	C	C	D	C	A
Critical Lane Group	no	no	no	no	yes	yes	yes	no
50th-Percentile Queue Length [veh]	0.08	1.06	0.08	0.34	1.97	0.58	9.92	0.92
50th-Percentile Queue Length [ft]	2.04	26.57	1.93	8.44	49.22	14.38	247.97	23.06
95th-Percentile Queue Length [veh]	0.15	1.91	0.14	0.61	3.54	1.04	15.08	1.66
95th-Percentile Queue Length [ft]	3.67	47.82	3.47	15.19	88.60	25.89	377.09	41.51

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.88	21.91	1.30	25.31	23.59	23.59	39.64	39.64	39.64	24.21	24.21	7.20
Movement LOS	C	C	A	C	C	C	D	D	D	C	C	A
d_A, Approach Delay [s/veh]	8.77			23.83			39.64			21.15		
Approach LOS	A			C			D			C		
d_I, Intersection Delay [s/veh]	19.57											
Intersection LOS	B											
Intersection V/C	0.621											

Sequence

Ring 1	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#5: 14th St SW and I-315 EB

Control Type:	Signalized	Delay (sec / veh):	13.3
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.218

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	7	66	286	142	91	60	44	69	3	20	30	5
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	14.30	1.50	1.70	3.50	4.40	5.00	0.00	4.30	0.00	10.00	3.30	0.00
Growth Rate	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	9	82	355	176	113	74	55	86	4	25	37	6
Peak Hour Factor	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	25	107	53	34	22	17	26	1	8	11	2
Total Analysis Volume [veh/h]	11	99	428	212	136	89	66	104	5	30	45	7
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	no
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal Group	0	2	3	0	6	7	7	4	0	3	8	0
Lead / Lag	-	-	-	-	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	0	5	15	0	5	15	15	5	0	15	15	0
Maximum Green [s]	0	50	20	0	50	20	20	60	0	20	60	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	22	18	0	22	18	18	20	0	18	20	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	5	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	10	10	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	1.0	0.0	3.0	1.0	1.0	3.0	0.0	1.0	3.0	0.0
Minimum Recall		no	no		no	no	no	no		no	no	
Maximum Recall		no	no		no	no	no	no		no	no	
Pedestrian Recall		no	no		no	no	no	no		no	no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	3.00	5.00	5.00	3.00	5.00	5.00	5.00	4.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	0.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	17	17	37	17	17	36	29	12	12	29	11	11
g / C, Green / Cycle	0.28	0.28	0.62	0.28	0.28	0.60	0.49	0.21	0.21	0.49	0.19	0.19
(v / s)_i Volume / Saturation Flow Rate	0.01	0.05	0.27	0.17	0.07	0.06	0.04	0.06	0.00	0.02	0.02	0.00
s, saturation flow rate [veh/h]	1114	1872	1588	1272	1820	1538	1616	1822	1615	1422	1839	1615
c, Capacity [veh/h]	334	530	979	387	515	920	948	376	333	816	346	304
d1, Uniform Delay [s]	19.78	16.28	6.04	22.47	16.66	5.14	8.16	20.04	18.95	8.07	20.26	19.85
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.04	0.17	0.31	1.21	0.27	0.05	0.03	0.39	0.02	0.02	0.17	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

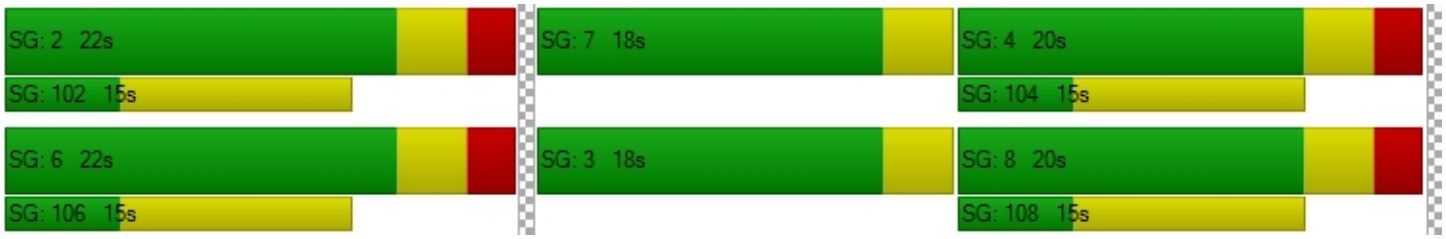
X, volume / capacity	0.03	0.19	0.44	0.55	0.26	0.10	0.07	0.28	0.01	0.04	0.13	0.02
d, Delay for Lane Group [s/veh]	19.82	16.44	6.35	23.68	16.93	5.19	8.20	20.43	18.97	8.08	20.43	19.88
Lane Group LOS	B	B	A	C	B	A	A	C	B	A	C	B
Critical Lane Group	no	no	yes	no	no	no	no	no	no	no	yes	no
50th-Percentile Queue Length [veh]	0.12	0.97	2.14	2.75	1.37	0.37	0.40	1.18	0.05	0.18	0.51	0.08
50th-Percentile Queue Length [ft]	3.03	24.30	53.51	68.66	34.27	9.31	9.90	29.58	1.34	4.43	12.70	1.94
95th-Percentile Queue Length [veh]	0.22	1.75	3.85	4.94	2.47	0.67	0.71	2.13	0.10	0.32	0.91	0.14
95th-Percentile Queue Length [ft]	5.46	43.75	96.31	123.59	61.69	16.75	17.82	53.25	2.41	7.97	22.86	3.49

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	19.82	16.44	6.35	23.68	16.93	5.19	8.20	20.43	18.97	8.08	20.43	19.88
Movement LOS	B	B	A	C	B	A	A	C	B	A	C	B
d_A, Approach Delay [s/veh]	8.48			17.81			15.78			15.87		
Approach LOS	A			B			B			B		
d_I, Intersection Delay [s/veh]	13.32											
Intersection LOS	B											
Intersection V/C	0.218											

Sequence

Ring 1	2	7	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#5: 14th St SW and I-315 EB

Control Type:	Signalized	Delay (sec / veh):	12.4
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.457

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	13	82	260	95	396	262	107	168	10	102	50	31
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.40	1.20	4.30	1.30	0.40	0.90	0.00	0.00	1.00	0.00	12.90
Growth Rate	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	16	102	322	118	491	325	133	208	12	126	62	38
Peak Hour Factor	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380	0.9380
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	4	27	86	31	131	87	35	55	3	34	17	10
Total Analysis Volume [veh/h]	17	109	343	126	523	346	142	222	13	134	66	41
Presence of On-Street Parking	no		no	no		no	no		no	no		no
On-Street Parking Maneuver Rate [/	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	no
Signal Coordination Group	-
Cycle Length [s]	60
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Semi-actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Overlap	Permiss	Permiss	Overlap	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal Group	0	2	3	0	6	7	7	4	0	3	8	0
Lead / Lag	-	-	-	-	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	0	5	15	0	5	15	15	5	0	15	15	0
Maximum Green [s]	0	50	20	0	50	20	20	45	0	20	45	0
Amber [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	22	18	0	22	18	18	20	0	18	20	0
Vehicle Extension [s]	0.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	3.0	3.0	0.0
Walk [s]	0	5	5	0	5	0	0	5	0	5	5	0
Pedestrian Clearance [s]	0	10	10	0	10	0	0	10	0	10	10	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	1.0	0.0	3.0	1.0	1.0	3.0	0.0	1.0	3.0	0.0
Minimum Recall		no	no		no	no	no	no		no	no	
Maximum Recall		no	no		no	no	no	no		no	no	
Pedestrian Recall		no	no		no	no	no	no		no	no	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	5.00	3.00	5.00	5.00	3.00	3.00	5.00	5.00	4.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	3.00	0.00	3.00	3.00	0.00	0.00	3.00	3.00	0.00	3.00	3.00
g_i, Effective Green Time [s]	21	21	41	21	21	41	33	15	15	33	15	15
g / C, Green / Cycle	0.35	0.35	0.68	0.35	0.35	0.68	0.55	0.25	0.25	0.55	0.25	0.25
(v / s)_i Volume / Saturation Flow Rate	0.02	0.06	0.21	0.10	0.28	0.22	0.09	0.12	0.01	0.09	0.03	0.03
s, saturation flow rate [veh/h]	893	1855	1596	1251	1876	1609	1564	1900	1615	1472	1900	1430
c, Capacity [veh/h]	183	647	1089	469	654	1097	998	466	396	872	466	351
d1, Uniform Delay [s]	26.40	13.51	3.86	17.33	17.64	3.86	6.75	19.34	17.22	7.01	17.69	17.58
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.20	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.22	0.12	0.16	0.30	2.31	0.30	0.06	0.75	0.03	0.08	0.14	0.15
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

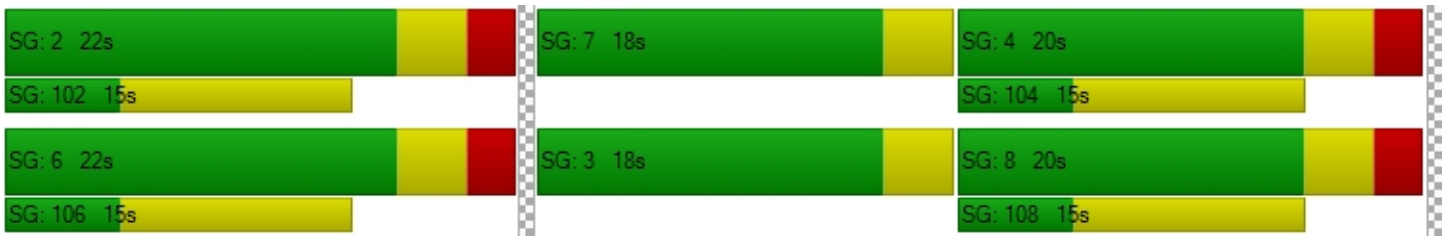
X, volume / capacity	0.09	0.17	0.32	0.27	0.80	0.32	0.14	0.48	0.03	0.15	0.14	0.12
d, Delay for Lane Group [s/veh]	26.62	13.63	4.03	17.63	19.95	4.16	6.82	20.09	17.25	7.09	17.83	17.73
Lane Group LOS	C	B	A	B	B	A	A	C	B	A	B	B
Critical Lane Group	no	no	no	no	yes	yes	no	yes	no	no	no	no
50th-Percentile Queue Length [veh]	0.23	0.94	1.10	1.32	6.19	1.15	0.74	2.53	0.13	0.70	0.68	0.42
50th-Percentile Queue Length [ft]	5.73	23.57	27.43	32.90	154.65	28.69	18.54	63.35	3.27	17.48	17.01	10.58
95th-Percentile Queue Length [veh]	0.41	1.70	1.97	2.37	10.26	2.07	1.33	4.56	0.24	1.26	1.22	0.76
95th-Percentile Queue Length [ft]	10.31	42.42	49.37	59.22	256.62	51.65	33.37	114.02	5.88	31.46	30.62	19.05

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.62	13.63	4.03	17.63	19.95	4.16	6.82	20.09	17.25	7.09	17.83	17.73
Movement LOS	C	B	A	B	B	A	A	C	B	A	B	B
d_A, Approach Delay [s/veh]	7.08			14.16			15.00			11.84		
Approach LOS	A			B			B			B		
d_I, Intersection Delay [s/veh]	12.45											
Intersection LOS	B											
Intersection V/C	0.457											

Sequence

Ring 1	2	7	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	6	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
#4: I-15 SB Off and Airport RD Frontage

Control Type:	Two-way stop	Delay (sec / veh):	121.8
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.947

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	5	0	44	159	54	96	8	12	0	0	40	4
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	11.30	10.10	7.40	3.10	12.50	8.30	2.00	2.00	2.50	0.00
Growth Rate	2.22	1.00	2.22	2.22	2.22	2.22	2.22	2.22	1.00	1.00	2.22	2.22
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	11	0	98	353	120	213	18	27	0	0	89	9
Peak Hour Factor	0.4170	1.0000	0.5240	0.8110	0.9000	0.7060	0.4000	0.7500	1.0000	1.0000	0.7690	0.5000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	7	0	47	109	33	75	11	9	0	0	29	5
Total Analysis Volume [veh/h]	26	0	187	435	133	302	45	36	0	0	116	18
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no	no		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.07	0.00	0.21	0.95	0.22	0.29	0.03	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	16.59	0.00	10.80	121.78	119.80	9.92	7.68	0.00	0.00	0.00	0.00	0.00
Movement LOS	C		B	F	F	A	A	A			A	A
95th-Percentile Queue Length [veh]	1.14	0.00	1.14	20.41	20.41	1.22	0.19	0.19	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	28.44	0.00	28.44	510.19	510.19	30.56	4.64	4.64	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	11.50			82.65			4.27			0.00		
Approach LOS	B			F			A			A		
d_I, Intersection Delay [s/veh]	57.55											
Intersection LOS	F											

Intersection Level Of Service Report
#4: I-15 SB Off and Airport RD Frontage

Control Type:	Two-way stop	Delay (sec / veh):	3,138.9
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	7.378

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	0	0	55	217	26	47	8	15	0	0	286	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	1.80	18.90	11.50	2.10	37.50	6.70	2.00	2.00	1.00	0.00
Growth Rate	2.22	1.00	2.22	2.22	2.22	2.22	2.22	2.22	1.00	1.00	2.22	2.22
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	122	482	58	104	18	33	0	0	635	2
Peak Hour Factor	1.0000	1.0000	0.7240	0.8350	0.7220	0.6910	0.6670	0.7500	1.0000	1.0000	0.6810	0.2500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	42	144	20	38	7	11	0	0	233	2
Total Analysis Volume [veh/h]	0	0	169	577	80	151	27	44	0	0	932	8
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no	no		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.53	7.38	0.38	0.15	0.04	0.00	0.00	0.00	0.01	0.00
d_M, Delay for Movement [s/veh]	47.75	0.00	27.94	3138.95	3109.90	9.11	11.25	0.00	0.00	0.00	0.00	0.00
Movement LOS	E		D	F	F	A	B	A			A	A
95th-Percentile Queue Length [veh]	2.88	0.00	2.88	74.83	74.83	0.52	0.40	0.40	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	72.12	0.00	72.12	1870.70	1870.70	12.88	9.95	9.95	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	27.94			2551.16			4.28			0.00		
Approach LOS	D			F			A			A		
d_I, Intersection Delay [s/veh]	1039.42											
Intersection LOS	F											

Intersection Level Of Service Report
#3: I-15 SB On and Airport RD

Control Type:	Two-way stop	Delay (sec / veh):	10.4
Analysis Method:	HCM2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.133

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	0	32	23	251	6
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	43.80	21.70	14.00	16.70
Growth Rate	1.00	1.00	2.12	2.12	2.12	2.12
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	68	49	532	13
Peak Hour Factor	1.0000	1.0000	0.6670	0.6390	0.8720	0.3750
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	25	19	153	9
Total Analysis Volume [veh/h]	0	0	102	77	610	35
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.13	0.00	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	10.39	0.00	0.00	0.00
Movement LOS			B	A	A	A
95th-Percentile Queue Length [veh]	0.00	0.00	0.90	0.90	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	22.46	22.46	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		5.92		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	1.29					
Intersection LOS	B					

Intersection Level Of Service Report
#3: I-15 SB On and Airport RD

Control Type:	Two-way stop	Delay (sec / veh):	23.5
Analysis Method:	HCM2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.305

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	0	0	25	21	542	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	64.00	19.10	7.30	0.00
Growth Rate	1.00	1.00	2.12	2.12	2.12	2.12
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	53	45	1149	30
Peak Hour Factor	1.0000	1.0000	0.6250	0.7500	0.7450	0.7000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	21	15	386	11
Total Analysis Volume [veh/h]	0	0	85	60	1542	43
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance			
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.30	0.00	0.02	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	23.48	0.00	0.00	0.00
Movement LOS			C	A	A	A
95th-Percentile Queue Length [veh]	0.00	0.00	2.79	2.79	0.00	0.00
95th-Percentile Queue Length [ft]	0.00	0.00	69.68	69.68	0.00	0.00
d_A, Approach Delay [s/veh]	0.00		13.76		0.00	
Approach LOS	A		B		A	
d_I, Intersection Delay [s/veh]	1.15					
Intersection LOS	C					

Intersection Level Of Service Report
#2: I-15 NB and Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	44.2
Analysis Method:	HCM2010	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.000

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	4	0	13	0	0	0	0	49	222	79	173	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	46.20	2.00	2.00	2.00	2.00	38.80	26.60	12.70	10.90	2.00
Growth Rate	1.90	1.90	1.90	1.00	1.00	1.00	1.00	1.90	1.90	1.90	1.90	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	8	0	25	0	0	0	0	93	422	150	329	0
Peak Hour Factor	0.5000	1.0000	0.8130	1.0000	1.0000	1.0000	1.0000	0.7210	0.8670	0.7050	0.9010	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	4	0	8	0	0	0	0	32	122	53	91	0
Total Analysis Volume [veh/h]	16	0	31	0	0	0	0	129	487	213	365	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	no			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	no			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.12	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00
d_M, Delay for Movement [s/veh]	34.72	44.22	13.81	0.00	0.00	0.00	0.00	0.00	0.00	10.13	0.00	0.00
Movement LOS	D	E	B					A	A	B	A	
95th-Percentile Queue Length [veh]	0.61	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.00	4.65	4.65	0.00
95th-Percentile Queue Length [ft]	15.29	15.29	15.29	0.00	0.00	0.00	0.00	0.00	0.00	116.18	116.18	0.00
d_A, Approach Delay [s/veh]	20.93			0.00			0.00			3.73		
Approach LOS	C			A			A			A		
d_I, Intersection Delay [s/veh]	2.53											
Intersection LOS	E											

Intersection Level Of Service Report
#2: I-15 NB and Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	10,000.0
Analysis Method:	HCM2010	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.159

Intersection Setup

Name												
Approach	Northeastbound			Southwestbound			Northwestbound			Southeastbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	yes			yes			yes			yes		

Volumes

Name												
Base Volume Input [veh/h]	2	2	31	0	0	0	0	47	197	307	236	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	47.40	2.00	2.00	2.00	2.00	40.40	20.80	0.70	17.40	2.00
Growth Rate	1.90	1.90	1.90	1.00	1.00	1.00	1.00	1.90	1.90	1.90	1.90	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	59	0	0	0	0	89	374	583	448	0
Peak Hour Factor	0.5000	0.5000	0.7750	1.0000	1.0000	1.0000	1.0000	0.6910	0.8210	0.6910	0.8680	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	2	19	0	0	0	0	32	114	211	129	0
Total Analysis Volume [veh/h]	8	8	76	0	0	0	0	129	456	844	516	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop			Stop			Free			Free	
Flared Lane	no										
Storage Area [veh]	0			0			0			0	
Two-Stage Gap Acceptance	no										
Number of Storage Spaces in Median	0			0			0			0	

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.01	0.00
d_M, Delay for Movement [s/veh]	10000.0	10000.0	10000.0	0.00	0.00	0.00	0.00	0.00	0.00	24.83	0.00	0.00
Movement LOS	F	F	F					A	A	C	A	
95th-Percentile Queue Length [veh]	13.97	13.97	13.97	0.00	0.00	0.00	0.00	0.00	0.00	54.79	54.79	0.00
95th-Percentile Queue Length [ft]	349.24	349.24	349.24	0.00	0.00	0.00	0.00	0.00	0.00	1369.74	1369.74	0.00
d_A, Approach Delay [s/veh]	10000.00			0.00			0.00			15.41		
Approach LOS	F			A			A			F		
d_I, Intersection Delay [s/veh]	461.93											
Intersection LOS	F											

Intersection Level Of Service Report
#1: Tri Hill and Frontage Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	27.3
Analysis Method:	HCM2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.514

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	83	19	9	189	97	88
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	21.70	31.10	22.20	28.60	25.70	5.70
Growth Rate	1.70	1.70	1.70	1.70	1.70	1.70
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	141	32	15	321	165	150
Peak Hour Factor	0.7410	0.4750	0.5630	0.8750	0.9330	0.7590
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	48	17	7	92	44	49
Total Analysis Volume [veh/h]	190	67	27	367	177	198
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.51	0.10	0.02	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	27.25	22.66	8.42	0.00	0.00	0.00
Movement LOS	D	C	A	A	A	A
95th-Percentile Queue Length [veh]	3.94	3.94	0.08	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	98.56	98.56	1.92	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	26.06		0.58		0.00	
Approach LOS	D		A		A	
d_I, Intersection Delay [s/veh]	6.75					
Intersection LOS	D					

Intersection Level Of Service Report
#1: Tri Hill and Frontage Airport Rd

Control Type:	Two-way stop	Delay (sec / veh):	43.7
Analysis Method:	HCM2010	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.713

Intersection Setup

Name						
Approach	Northeastbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	yes		yes		yes	

Volumes

Name						
Base Volume Input [veh/h]	75	7	9	160	207	70
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.70	0.00	22.20	33.80	18.90	15.80
Growth Rate	1.70	1.70	1.70	1.70	1.70	1.70
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [ve	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	128	12	15	272	352	119
Peak Hour Factor	0.5680	0.4380	0.7500	0.8000	0.8480	0.8330
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	56	7	5	85	104	36
Total Analysis Volume [veh/h]	225	27	20	340	415	143
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	no		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	no		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.71	0.05	0.02	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	43.71	38.46	9.00	0.00	0.00	0.00
Movement LOS	E	E	A	A	A	A
95th-Percentile Queue Length [veh]	5.93	5.93	0.07	0.00	0.00	0.00
95th-Percentile Queue Length [ft]	148.33	148.33	1.67	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	43.15		0.50		0.00	
Approach LOS	E		A		A	
d_I, Intersection Delay [s/veh]	9.45					
Intersection LOS	E					

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	352	86	12	144	218	72	242	47	393	195	16
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1776	1776	1776	1776	1776	1776	1900	1900	1776	1900
Adj Flow Rate, veh/h	22	517	126	18	211	320	106	355	69	577	286	23
Adj No. of Lanes	1	1	1	1	1	1	1	2	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	7	7	7	7	7	7	7	7	7	7	7	7
Cap, veh/h	311	599	509	152	594	928	262	437	84	474	454	37
Arrive On Green	0.02	0.34	0.34	0.02	0.33	0.33	0.15	0.15	0.15	0.28	0.28	0.28
Sat Flow, veh/h	1691	1776	1509	1691	1776	1509	1691	2824	543	1691	1622	130
Grp Volume(v), veh/h	22	517	126	18	211	320	106	211	213	577	0	309
Grp Sat Flow(s),veh/h/ln	1691	1776	1509	1691	1776	1509	1691	1687	1680	1691	0	1753
Q Serve(g_s), s	0.8	25.7	5.7	0.7	8.5	9.8	5.3	11.4	11.6	26.4	0.0	14.5
Cycle Q Clear(g_c), s	0.8	25.7	5.7	0.7	8.5	9.8	5.3	11.4	11.6	26.4	0.0	14.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.32	1.00		0.07
Lane Grp Cap(c), veh/h	311	599	509	152	594	928	262	261	260	474	0	491
V/C Ratio(X)	0.07	0.86	0.25	0.12	0.36	0.34	0.41	0.81	0.82	1.22	0.00	0.63
Avail Cap(c_a), veh/h	360	693	589	206	693	1012	310	310	308	474	0	491
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.4	29.2	22.6	23.6	23.7	8.9	35.9	38.5	38.6	33.9	0.0	29.7
Incr Delay (d2), s/veh	0.1	9.9	0.3	0.3	0.4	0.2	1.0	12.6	14.0	116.3	0.0	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	14.1	2.4	0.3	4.2	7.1	2.5	6.2	6.4	27.5	0.0	7.4
LnGrp Delay(d),s/veh	20.5	39.1	22.8	24.0	24.0	9.1	36.9	51.1	52.6	150.2	0.0	32.2
LnGrp LOS	C	D	C	C	C	A	D	D	D	F		C
Approach Vol, veh/h		665			549			530			886	
Approach Delay, s/veh		35.4			15.3			48.9			109.1	
Approach LOS		D			B			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		19.6	6.5	36.8		31.4	6.8	36.5
Change Period (Y+Rc), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s		17.3	4.5	36.8		26.4	4.5	36.8
Max Q Clear Time (g_c+I1), s		13.6	2.7	27.7		28.4	2.8	11.8
Green Ext Time (p_c), s		1.0	0.0	4.1		0.0	0.0	6.6

Intersection Summary	
HCM 2010 Ctrl Delay	58.7
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	19	326	92	39	313	403	149	435	53	338	206	25
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1900	1900	1845	1900
Adj Flow Rate, veh/h	28	478	135	57	459	591	219	638	78	496	302	37
Adj No. of Lanes	1	1	1	1	1	1	1	2	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	171	597	507	200	618	888	371	664	81	406	373	46
Arrive On Green	0.02	0.32	0.32	0.03	0.34	0.34	0.21	0.21	0.21	0.23	0.23	0.23
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	3145	384	1757	1612	198
Grp Volume(v), veh/h	28	478	135	57	459	591	219	355	361	496	0	339
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1752	1777	1757	0	1810
Q Serve(g_s), s	1.1	23.5	6.3	2.1	21.9	26.1	11.2	19.9	20.0	23.0	0.0	17.6
Cycle Q Clear(g_c), s	1.1	23.5	6.3	2.1	21.9	26.1	11.2	19.9	20.0	23.0	0.0	17.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.22	1.00		0.11
Lane Grp Cap(c), veh/h	171	597	507	200	618	888	371	370	375	406	0	418
V/C Ratio(X)	0.16	0.80	0.27	0.29	0.74	0.67	0.59	0.96	0.96	1.22	0.00	0.81
Avail Cap(c_a), veh/h	213	677	575	221	677	938	371	370	375	406	0	418
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.0	30.7	24.9	24.3	29.3	15.0	35.4	38.8	38.8	38.2	0.0	36.2
Incr Delay (d2), s/veh	0.4	6.1	0.3	0.8	4.0	1.7	2.5	36.2	36.5	119.8	0.0	11.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	13.0	2.8	1.1	11.8	16.5	5.7	13.4	13.6	24.6	0.0	10.1
LnGrp Delay(d),s/veh	24.4	36.8	25.2	25.0	33.3	16.7	37.8	75.1	75.4	158.1	0.0	47.6
LnGrp LOS	C	D	C	C	C	B	D	E	E	F		D
Approach Vol, veh/h		641			1107			935			835	
Approach Delay, s/veh		33.8			24.0			66.5			113.2	
Approach LOS		C			C			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		26.0	8.3	37.2		28.0	7.2	38.3
Change Period (Y+Rc), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Green Setting (Gmax), s		21.0	4.5	36.5		23.0	4.5	36.5
Max Q Clear Time (g_c+I1), s		22.0	4.1	25.5		25.0	3.1	28.1
Green Ext Time (p_c), s		0.0	0.0	6.3		0.0	0.0	5.2

Intersection Summary	
HCM 2010 Ctrl Delay	58.3
HCM 2010 LOS	E

Intersection	
Int Delay, s/veh	5.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	477	254	26	364	84	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	250	150	-	0	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	7	7	7	7	7
Mvmt Flow	700	373	38	534	123	51

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	700	0	1310	700
Stage 1	-	-	-	-	700	-
Stage 2	-	-	-	-	610	-
Critical Hdwy	-	-	4.17	-	6.47	6.27
Critical Hdwy Stg 1	-	-	-	-	5.47	-
Critical Hdwy Stg 2	-	-	-	-	5.47	-
Follow-up Hdwy	-	-	2.263	-	3.563	3.363
Pot Cap-1 Maneuver	-	-	874	-	171	431
Stage 1	-	-	-	-	483	-
Stage 2	-	-	-	-	533	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	874	-	164	431
Mov Cap-2 Maneuver	-	-	-	-	164	-
Stage 1	-	-	-	-	483	-
Stage 2	-	-	-	-	510	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	56.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	164	431	-	-	874	-
HCM Lane V/C Ratio	0.752	0.119	-	-	0.044	-
HCM Control Delay (s)	73.8	14.5	-	-	9.3	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	4.7	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	33.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	494	256	54	622	100	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	250	150	-	0	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	725	376	79	913	147	41

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	725	0	1796	725
Stage 1	-	-	-	-	725	-
Stage 2	-	-	-	-	1071	-
Critical Hdwy	-	-	4.15	-	6.45	6.25
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	-	-	2.245	-	3.545	3.345
Pot Cap-1 Maneuver	-	-	864	-	~ 87	420
Stage 1	-	-	-	-	474	-
Stage 2	-	-	-	-	325	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	864	-	~ 79	420
Mov Cap-2 Maneuver	-	-	-	-	~ 79	-
Stage 1	-	-	-	-	474	-
Stage 2	-	-	-	-	295	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	$ 407.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	79	420	-	-	864	-
HCM Lane V/C Ratio	1.857	0.098	-	-	0.092	-
HCM Control Delay (s)	$ 517.9	14.5	-	-	9.6	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	12.8	0.3	-	-	0.3	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	391	135	8	200	0	184	1	26	0	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1759	1759	1900	1759	1759	1900	1759	1759	1900	1900	1759	1900
Adj Flow Rate, veh/h	3	574	198	12	293	0	270	1	38	0	0	0
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	8	8	8	8	8	8	8	8	8	8	8	8
Cap, veh/h	647	702	242	287	986	0	519	8	310	0	373	0
Arrive On Green	0.56	0.56	0.56	0.56	0.56	0.00	0.21	0.21	0.21	0.00	0.00	0.00
Sat Flow, veh/h	1022	1251	432	656	1759	0	1675	38	1463	0	1759	0
Grp Volume(v), veh/h	3	0	772	12	293	0	270	0	39	0	0	0
Grp Sat Flow(s),veh/h/ln	1022	0	1683	656	1759	0	1675	0	1501	0	1759	0
Q Serve(g_s), s	0.1	0.0	16.4	0.7	3.9	0.0	6.7	0.0	0.9	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.9	0.0	16.4	17.1	3.9	0.0	6.7	0.0	0.9	0.0	0.0	0.0
Prop In Lane	1.00		0.26	1.00		0.00	1.00		0.97	0.00		0.00
Lane Grp Cap(c), veh/h	647	0	944	287	986	0	519	0	318	0	373	0
V/C Ratio(X)	0.00	0.00	0.82	0.04	0.30	0.00	0.52	0.00	0.12	0.00	0.00	0.00
Avail Cap(c_a), veh/h	817	0	1224	396	1279	0	849	0	614	0	719	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	6.1	0.0	7.8	14.8	5.1	0.0	16.3	0.0	14.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	3.5	0.1	0.2	0.0	0.8	0.0	0.2	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	8.2	0.1	1.9	0.0	3.2	0.0	0.4	0.0	0.0	0.0
LnGrp Delay(d),s/veh	6.1	0.0	11.3	14.8	5.3	0.0	17.1	0.0	14.2	0.0	0.0	0.0
LnGrp LOS	A		B	B	A		B		B			
Approach Vol, veh/h		775			305			309			0	
Approach Delay, s/veh		11.3			5.6			16.7			0.0	
Approach LOS		B			A			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		14.3		29.7		14.3		29.7
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		18.0		32.0		18.0		32.0
Max Q Clear Time (g_c+I1), s		8.7		18.4		0.0		19.1
Green Ext Time (p_c), s		0.7		5.8		0.0		5.6

Intersection Summary	
HCM 2010 Ctrl Delay	11.3
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	273	227	51	480	1	167	0	21	2	1	2
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1900	1792	1792	1900	1792	1792	1900	1900	1792	1900
Adj Flow Rate, veh/h	0	401	333	75	704	1	245	0	31	3	1	3
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	143	525	436	313	1037	1	445	0	338	209	84	143
Arrive On Green	0.00	0.58	0.58	0.58	0.58	0.58	0.22	0.00	0.22	0.22	0.22	0.22
Sat Flow, veh/h	712	907	753	693	1789	3	1354	0	1524	482	378	646
Grp Volume(v), veh/h	0	0	734	75	0	705	245	0	31	7	0	0
Grp Sat Flow(s),veh/h/ln	712	0	1660	693	0	1792	1354	0	1524	1506	0	0
Q Serve(g_s), s	0.0	0.0	16.8	4.6	0.0	13.7	8.4	0.0	0.8	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	16.8	21.4	0.0	13.7	8.6	0.0	0.8	0.2	0.0	0.0
Prop In Lane	1.00		0.45	1.00		0.00	1.00		1.00	0.43		0.43
Lane Grp Cap(c), veh/h	143	0	961	313	0	1038	445	0	338	436	0	0
V/C Ratio(X)	0.00	0.00	0.76	0.24	0.00	0.68	0.55	0.00	0.09	0.02	0.00	0.00
Avail Cap(c_a), veh/h	184	0	1056	353	0	1140	629	0	545	635	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	8.0	16.0	0.0	7.3	18.6	0.0	15.5	15.3	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	3.1	0.4	0.0	1.5	1.1	0.0	0.1	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	8.4	0.9	0.0	7.1	3.3	0.0	0.3	0.1	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.0	11.0	16.4	0.0	8.8	19.6	0.0	15.7	15.3	0.0	0.0
LnGrp LOS			B	B		A	B		B	B		
Approach Vol, veh/h		734			780			276			7	
Approach Delay, s/veh		11.0			9.5			19.2			15.3	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		16.2		34.1		16.2		34.1
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		18.0		32.0		18.0		32.0
Max Q Clear Time (g_c+I1), s		10.6		18.8		2.2		23.4
Green Ext Time (p_c), s		0.6		7.9		0.8		5.8

Intersection Summary	
HCM 2010 Ctrl Delay	11.7
HCM 2010 LOS	B

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*36th Ave. NE / Bootlegger Tr.*
Jurisdiction	*Great Falls*
Analysis Year	

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *36th Avenue NE* | North/South Street: *Bootlegger Trail*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*41*	*32*	*0*	*0*	*151*	*12*
Peak-Hour Factor, PHF	*0.64*	*0.80*	*0.25*	*0.25*	*0.79*	*0.60*
Hourly Flow Rate, HFR (veh/h)	*64*	*39*	*0*	*0*	*191*	*19*
Percent Heavy Vehicles	*5*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*13*	*0*	*290*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.81*	*0.25*	*0.76*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*381*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*3*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*64*	*0*		*0*			*397*	
C (m) (veh/h)	*1343*	*1584*					*822*	
v/c	*0.05*	*0.00*					*0.48*	
95% queue length	*0.15*	*0.00*					*2.67*	
Control Delay (s/veh)	*7.8*	*7.3*					*13.4*	
LOS	*A*	*A*					*B*	
Approach Delay (s/veh)	--	--				*13.4*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*36th Ave. NE / Bootlegger Tr.*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *36th Avenue NE* | North/South Street: *Bootlegger Trail*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*236*	*111*	*0*	*0*	*58*	*18*
Peak-Hour Factor, PHF	*0.88*	*0.84*	*0.25*	*0.25*	*0.85*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*268*	*132*	*0*	*0*	*68*	*24*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*33*	*0*	*92*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.64*	*0.25*	*0.92*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*51*	*0*	*99*	*0*	*0*	*0*
Percent Heavy Vehicles	*3*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*268*	*0*		*0*			*150*	
C (m) (veh/h)	*1515*	*1466*					*530*	
v/c	*0.18*	*0.00*					*0.28*	
95% queue length	*0.64*	*0.00*					*1.16*	
Control Delay (s/veh)	*7.9*	*7.5*					*14.5*	
LOS	*A*	*A*					*B*	
Approach Delay (s/veh)	--	--				*14.5*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*Bootlegger Tr. / U.S. 87*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Bootlegger Trail* North/South Street: *U.S. 87*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*106*	*118*	*5*	*0*	*113*	*8*
Peak-Hour Factor, PHF	*0.76*	*0.92*	*0.42*	*0.25*	*0.71*	*0.67*
Hourly Flow Rate, HFR (veh/h)	*139*	*128*	*11*	*0*	*159*	*11*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*	*0*	*435*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.73*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*15*	*0*	*595*	*0*	*0*	*0*
Percent Heavy Vehicles	*10*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*139*	*0*		*0*			*610*	
C (m) (veh/h)	*1420*	*1457*					*946*	
v/c	*0.10*	*0.00*					*0.64*	
95% queue length	*0.32*	*0.00*					*4.88*	
Control Delay (s/veh)	*7.8*	*7.5*					*15.4*	
LOS	*A*	*A*					*C*	
Approach Delay (s/veh)	--	--				*15.4*		
Approach LOS	--	--				*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Bootlegger Tr. / U.S. 87*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Bootlegger Trail* | North/South Street: *U.S. 87*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*391*	*174*	*0*	*0*	*177*	*11*
Peak-Hour Factor, PHF	*0.80*	*0.91*	*0.25*	*0.25*	*0.81*	
Hourly Flow Rate, HFR (veh/h)	*488*	*191*	*0*	*0*	*218*	*11*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*216*	*6*	*0*	*1*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.83*	*0.75*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*7*	*0*	*260*	*8*	*0*	*4*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*488*	*0*		*12*			*267*	
C (m) (veh/h)	*1351*	*1395*		*96*			*750*	
v/c	*0.36*	*0.00*		*0.13*			*0.36*	
95% queue length	*1.67*	*0.00*		*0.41*			*1.62*	
Control Delay (s/veh)	*9.2*	*7.6*		*47.8*			*12.4*	
LOS	*A*	*A*		*E*			*B*	
Approach Delay (s/veh)	--	--	*47.8*			*12.4*		
Approach LOS	--	--	*E*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Trisha Bodlovic*	Intersection	*Old Havre Hwy / 15th St. N*
Agency/Co.	*Robert Peccia & Associates*	Jurisdiction	*Great Falls*
Date Performed	*6/19/2013*	Analysis Year	*2013 - Existing*
Analysis Time Period	*AM Peak Hour*		

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Old Havre Highway* | North/South Street: *15th Street North*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*8*	*135*	*7*	*0*	*379*	*181*
Peak-Hour Factor, PHF	*0.40*	*0.89*	*0.58*	*0.25*	*0.77*	*0.72*
Hourly Flow Rate, HFR (veh/h)	*19*	*151*	*12*	*0*	*492*	*251*
Percent Heavy Vehicles	*13*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*1*
Lanes	*1*	*2*	*0*	*1*	*2*	*1*
Configuration	*L*	*T*	*TR*	*L*	*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*89*	*5*	*8*	*3*	*2*	*1*
Peak-Hour Factor, PHF	*0.86*	*0.63*	*0.50*	*0.38*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*103*	*7*	*16*	*7*	*8*	*4*
Percent Heavy Vehicles	*20*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*19*	*0*		*19*			*126*	
C (m) (veh/h)	*994*	*1428*		*467*			*360*	
v/c	*0.02*	*0.00*		*0.04*			*0.35*	
95% queue length	*0.06*	*0.00*		*0.13*			*1.53*	
Control Delay (s/veh)	*8.7*	*7.5*		*13.0*			*20.3*	
LOS	*A*	*A*		*B*			*C*	
Approach Delay (s/veh)	--	--	*13.0*			*20.3*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/19/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Old Havre Hwy / 15th St. N*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Old Havre Highway* | North/South Street: *15th Street North*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*9*	*323*	*8*	*1*	*181*	*161*
Peak-Hour Factor, PHF	*0.56*	*0.89*	*0.67*	*0.25*	*0.87*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*16*	*362*	*11*	*4*	*208*	*191*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*1*
Lanes	*1*	*2*	*0*	*1*	*2*	*1*
Configuration	*L*	*T*	*TR*	*L*	*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*188*	*4*	*10*	*4*	*5*	*0*
Peak-Hour Factor, PHF	*0.94*	*0.50*	*0.42*	*0.50*	*0.63*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*200*	*8*	*23*	*8*	*7*	*0*
Percent Heavy Vehicles	*8*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*16*	*4*		*15*			*231*	
C (m) (veh/h)	*1375*	*1197*		*414*			*502*	
v/c	*0.01*	*0.00*		*0.04*			*0.46*	
95% queue length	*0.04*	*0.01*		*0.11*			*2.39*	
Control Delay (s/veh)	*7.6*	*8.0*		*14.0*			*18.1*	
LOS	*A*	*A*		*B*			*C*	
Approach Delay (s/veh)	--	--	*14.0*			*18.1*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*25th Ave. NE / 8th St. NE*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *25th Avenue NE* | North/South Street: *8th Street NE*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*167*	*57*	*153*	*270*	*8*
Peak-Hour Factor, PHF	*0.63*	*0.62*	*0.59*	*0.74*	*0.73*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*7*	*269*	*96*	*206*	*369*	*11*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*48*	*9*	*17*	*19*	*62*
Peak-Hour Factor, PHF	*0.50*	*0.92*	*0.56*	*0.53*	*0.53*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*12*	*52*	*16*	*32*	*35*	*87*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*7*	*206*		*154*			*80*	
C (m) (veh/h)	*1182*	*1197*		*234*			*162*	
v/c	*0.01*	*0.17*		*0.66*			*0.49*	
95% queue length	*0.02*	*0.62*		*4.10*			*2.38*	
Control Delay (s/veh)	*8.1*	*8.6*		*45.8*			*47.2*	
LOS	*A*	*A*		*E*			*E*	
Approach Delay (s/veh)	--	--	*45.8*			*47.2*		
Approach LOS	--	--	*E*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*25th Ave. NE / 8th St. NE*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *25th Avenue NE* | North/South Street: *8th Street NE*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*14*	*190*	*28*	*59*	*119*	*3*
Peak-Hour Factor, PHF	*0.50*	*0.78*	*0.88*	*0.87*	*0.83*	*0.38*
Hourly Flow Rate, HFR (veh/h)	*28*	*243*	*31*	*67*	*143*	*7*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*2*	*24*	*17*	*36*	*67*	*175*
Peak-Hour Factor, PHF	*0.25*	*0.75*	*0.53*	*0.75*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*8*	*32*	*32*	*48*	*79*	*208*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*1*	*1*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*28*	*67*		*335*			*72*	
C (m) (veh/h)	*1444*	*1301*		*546*			*448*	
v/c	*0.02*	*0.05*		*0.61*			*0.16*	
95% queue length	*0.06*	*0.16*		*4.12*			*0.57*	
Control Delay (s/veh)	*7.5*	*7.9*		*21.5*			*14.6*	
LOS	*A*	*A*		*C*			*B*	
Approach Delay (s/veh)	--	--	*21.5*			*14.6*		
Approach LOS	--	--	*C*			*B*		

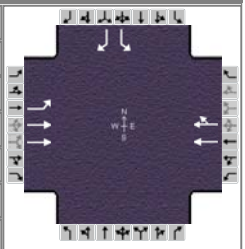
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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.83
Intersection	Smelter Ave. / 6th St. NE	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	19_SmelterAve_6thStNE_AM.xus				
Project Description	Great Falls Area LRTP				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	39	915			810	29				177		143

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.4	62.0	18.0	0.0	0.0	0.0				
Yellow	3.7	3.9	3.9	0.0	0.0	0.0				
Red	0.9	1.1	1.1	0.0	0.0	0.0	5	6	7	8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	10.0	77.0		67.0				23.0
Change Period, *(Y+Rc)*, s	4.6	5.0		5.0				5.0
Max Allow Headway *(MAH)*, s	3.1	0.0		0.0				3.2
Queue Clearance Time *(g_s)*, s	2.9							14.4
Green Extension Time *(g_e)*, s	0.0	0.0		0.0				0.3
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							0.78

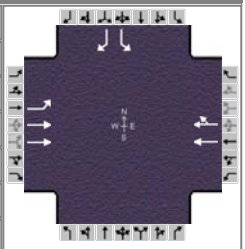
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6			2	12				7		14
Adjusted Flow Rate *(v)*, veh/h	47	1102			509	502				213		172
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1556			1635	1612				1619		1441
Queue Service Time *(g_s)*, s	0.9	15.4			17.2	17.2				12.4		11.1
Cycle Queue Clearance Time *(g_c)*, s	0.9	15.4			17.2	17.2				12.4		11.1
Capacity *(c)*, veh/h	413	2241			1013	999				291		259
Volume-to-Capacity Ratio *(X)*	0.114	0.492			0.502	0.502				0.732		0.664
Available Capacity *(c_a)*, veh/h	413	2241			1013	999				291		259
Back of Queue *(Q)*, veh/ln (50th percentile)	0.3	4.0			5.8	5.7				5.4		4.2
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0			0.0	0.0				0.0		0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay *(d_1)*, s/veh	6.8	6.1			10.5	10.5				38.7		38.2
Incremental Delay *(d_2)*, s/veh	0.0	0.8			1.8	1.8				8.0		5.1
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay *(d)*, s/veh	6.9	6.8			12.3	12.3				46.7		43.3
Level of Service (LOS)	A	A			B	B				D		D
Approach Delay, s/veh / LOS	6.8	A		12.3	B		0.0			45.2	D	
Intersection Delay, s/veh / LOS	14.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.2	B	2.7	B	2.9	C
Bicycle LOS Score / LOS	1.4	A	1.3	A				F

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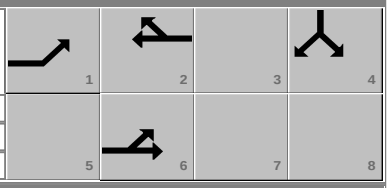
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.97
Intersection	Smelter Ave. / 6th St. NE	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	19_SmelterAve_6thStNE_PM.xus				
Project Description	Great Falls Area LRTP				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	76	1033			1300	72				102		103

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.4	75.0	15.0	0.0	0.0	0.0
Yellow	3.7	3.9	3.9	0.0	0.0	0.0
Red	0.9	1.1	1.1	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	10.0	90.0		80.0				20.0
Change Period, *(Y+Rc)*, s	4.6	5.0		5.0				5.0
Max Allow Headway *(MAH)*, s	3.1	0.0		0.0				3.2
Queue Clearance Time *(g_s)*, s	3.4							9.6
Green Extension Time *(g_e)*, s	0.0	0.0		0.0				0.2
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							0.12

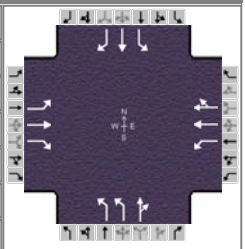
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6			2	12				7		14
Adjusted Flow Rate *(v)*, veh/h	78	1065			713	701				105		106
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1602			1667	1631				1619		1441
Queue Service Time *(g_s)*, s	1.4	12.4			26.2	26.4				6.6		7.6
Cycle Queue Clearance Time *(g_c)*, s	1.4	12.4			26.2	26.4				6.6		7.6
Capacity *(c)*, veh/h	315	2476			1136	1112				221		196
Volume-to-Capacity Ratio *(X)*	0.248	0.430			0.628	0.630				0.476		0.541
Available Capacity *(c_a)*, veh/h	315	2476			1136	1112				221		196
Back of Queue *(Q)*, veh/ln (50th percentile)	0.5	3.0			8.8	8.7				2.6		2.7
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0			0.0	0.0				0.0		0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay *(d_1)*, s/veh	8.2	4.3			9.7	9.8				43.9		44.3
Incremental Delay *(d_2)*, s/veh	0.2	0.5			2.6	2.7				0.6		1.7
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay *(d)*, s/veh	8.4	4.8			12.4	12.5				44.5		45.9
Level of Service (LOS)	A	A			B	B				D		D
Approach Delay, s/veh / LOS	5.0	A		12.4	B		0.0			45.2	D	
Intersection Delay, s/veh / LOS	11.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.6	A	2.2	B	2.7	B	2.9	C
Bicycle LOS Score / LOS	1.4	A	1.7	A				F

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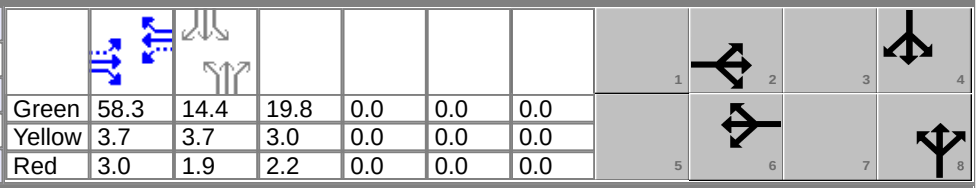
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.82
Intersection	Smelter Ave. / 10th St. NE	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	20_SmelterAve_10thStNE_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	142	136	789	41	190	23	527	98	23	10	176	136

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	58.3	14.4	19.8	0.0	0.0	0.0						
Yellow	3.7	3.7	3.0	0.0	0.0	0.0						
Red	3.0	1.9	2.2	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		5.0		6.0		10.0		9.0
Phase Duration, s		65.0		65.0		25.0		20.0
Change Period, *(Y+Rc)*, s		6.7		6.7		5.2		5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		4.1		4.1
Queue Clearance Time *(g_s)*, s						21.8		16.1
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

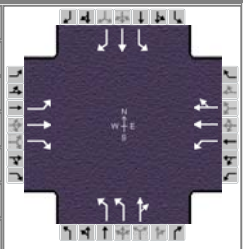
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	173	166	962	50	131	129	643	148		12	215	166
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1034	1650	1396	507	1650	1588	1541	1627		1619	1667	1295
Queue Service Time *(g_s)*, s	11.3	5.8	58.3	6.3	4.5	4.6	19.8	9.0		0.7	14.1	14.0
Cycle Queue Clearance Time *(g_c)*, s	15.9	5.8	58.3	12.1	4.5	4.6	19.8	9.0		0.7	14.1	14.0
Capacity *(c)*, veh/h	571	875	740	308	875	842	555	293		212	218	170
Volume-to-Capacity Ratio *(X)*	0.303	0.190	1.301	0.163	0.150	0.153	1.158	0.504		0.058	0.984	0.978
Available Capacity *(c_a)*, veh/h	571	875	740	308	875	842	555	293		212	218	170
Back of Queue *(Q)*, veh/ln (50th percentile)	2.8	2.1	47.2	0.8	1.7	1.6	14.3	3.6		0.3	9.1	7.4
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	17.3	13.5	25.9	16.7	13.2	13.2	45.1	40.7		41.9	47.7	47.6
Incremental Delay *(d_2)*, s/veh	1.4	0.5	145.2	1.1	0.4	0.4	90.0	1.4		0.1	56.1	62.5
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	18.6	14.0	171.1	17.8	13.6	13.6	135.1	42.0		42.0	103.8	110.2
Level of Service (LOS)	B	B	F	B	B	B	F	D		D	F	F
Approach Delay, s/veh / LOS	130.8	F		14.3	B		117.7	F		104.6	F	
Intersection Delay, s/veh / LOS	110.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	2.5	B	2.9	C
Bicycle LOS Score / LOS	2.6	B	0.7	A	1.8	A	1.1	A

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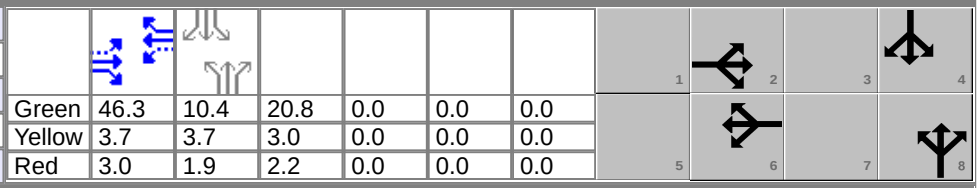
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.95
Intersection	Smelter Ave. / 10th St. NE	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	20_SmelterAve_10thStNE_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	154	198	833	54	373	23	869	175	61	15	139	211

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	46.3	10.4	20.8	0.0	0.0	0.0						
Yellow	3.7	3.7	3.0	0.0	0.0	0.0						
Red	3.0	1.9	2.2	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		5.0		6.0		10.0		9.0
Phase Duration, s		53.0		53.0		26.0		16.0
Change Period, *(Y+Rc)*, s		6.7		6.7		5.2		5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		4.1		4.2
Queue Clearance Time *(g_s)*, s						22.8		12.4
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

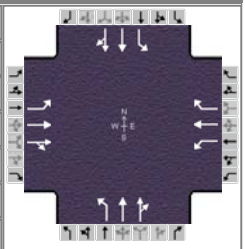
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	162	208	877	57	210	207	915	248		16	146	222
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	965	1683	1397	528	1700	1665	1572	1624		1619	1667	1326
Queue Service Time *(g_s)*, s	11.2	6.9	46.3	6.7	6.9	6.9	20.8	13.4		0.8	8.1	10.4
Cycle Queue Clearance Time *(g_c)*, s	18.1	6.9	46.3	13.6	6.9	6.9	20.8	13.4		0.8	8.1	10.4
Capacity *(c)*, veh/h	476	820	681	295	829	811	688	356		177	182	145
Volume-to-Capacity Ratio *(X)*	0.341	0.254	1.288	0.193	0.253	0.255	1.329	0.698		0.089	0.802	1.531
Available Capacity *(c_a)*, veh/h	476	820	681	295	829	811	688	356		177	182	145
Back of Queue *(Q)*, veh/ln (50th percentile)	2.6	2.6	40.1	0.9	2.6	2.6	22.7	5.7		0.3	4.4	14.2
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	19.6	14.2	24.4	18.2	14.2	14.3	37.1	34.2		38.0	41.3	42.3
Incremental Delay *(d_2)*, s/veh	1.9	0.7	140.5	1.5	0.7	0.8	157.8	5.9		0.2	22.1	270.4
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	21.5	15.0	164.9	19.7	15.0	15.0	194.9	40.1		38.3	63.4	312.7
Level of Service (LOS)	C	B	F	B	B	B	F	D		D	E	F
Approach Delay, s/veh / LOS	121.2	F		15.6	B		161.9	F		206.5	F	
Intersection Delay, s/veh / LOS	130.4						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	2.5	B	2.8	C
Bicycle LOS Score / LOS	2.5	B	0.9	A	2.4	B	1.1	A

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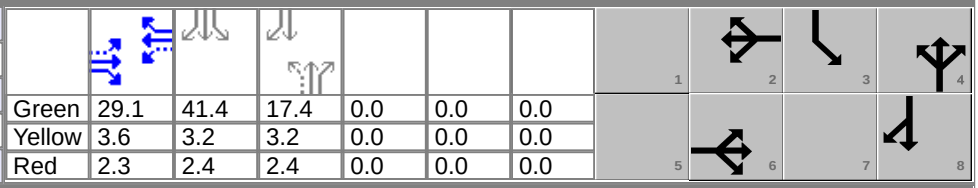
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	River Rd. / 9th St. N	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	RiverRd_9thStN_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	58	234	11	5	92	201	9	213	21	324	329	145

Signal Information			
Cycle, s	105.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	29.1	41.4	17.4	0.0	0.0	0.0
Yellow	3.6	3.2	3.2	0.0	0.0	0.0
Red	2.3	2.4	2.4	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		6		2		4	3	8
Case Number		6.0		5.0		6.3	2.0	4.0
Phase Duration, s		35.0		35.0		23.0	47.0	70.0
Change Period, *(Y+Rc)*, s		5.9		5.9		5.6	5.6	5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		2.1	2.6	2.1
Queue Clearance Time *(g_s)*, s						9.3	19.7	9.8
Green Extension Time *(g_e)*, s		0.0		0.0		0.5	0.4	0.5
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						0.01	0.00	0.00

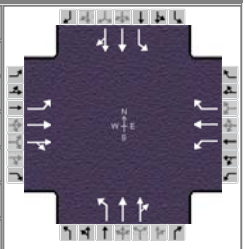
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	63	134	133	5	100	218	10	128	126	352	269	246
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1078	1700	1673	1130	1700	1441	894	1700	1646	1619	1700	1521
Queue Service Time *(g_s)*, s	5.0	6.5	6.5	0.4	4.7	13.6	1.0	7.1	7.3	17.7	7.6	7.8
Cycle Queue Clearance Time *(g_c)*, s	9.8	6.5	6.5	6.9	4.7	13.6	1.0	7.1	7.3	17.7	7.6	7.8
Capacity *(c)*, veh/h	319	471	464	311	471	399	217	282	273	638	1043	933
Volume-to-Capacity Ratio *(X)*	0.198	0.284	0.286	0.017	0.212	0.547	0.045	0.455	0.463	0.552	0.258	0.264
Available Capacity *(c_a)*, veh/h	319	471	464	311	471	399	217	282	273	638	1043	933
Back of Queue *(Q)*, veh/ln (50th percentile)	1.4	2.8	2.8	0.1	2.0	5.2	0.2	3.0	2.9	6.7	2.6	2.4
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	32.9	29.8	29.8	32.5	29.1	32.3	36.9	39.5	39.6	24.6	9.3	9.4
Incremental Delay *(d_2)*, s/veh	1.4	1.5	1.5	0.1	1.0	5.3	0.0	0.4	0.5	0.6	0.0	0.1
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	34.3	31.3	31.3	32.6	30.2	37.6	37.0	39.9	40.0	25.2	9.4	9.4
Level of Service (LOS)	C	C	C	C	C	D	D	D	D	C	A	A
Approach Delay, s/veh / LOS	31.9	C		35.3	D		39.9	D		15.8	B	
Intersection Delay, s/veh / LOS	25.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.9	C	2.4	B
Bicycle LOS Score / LOS	0.8	A	1.0	A	0.7	A	1.2	A

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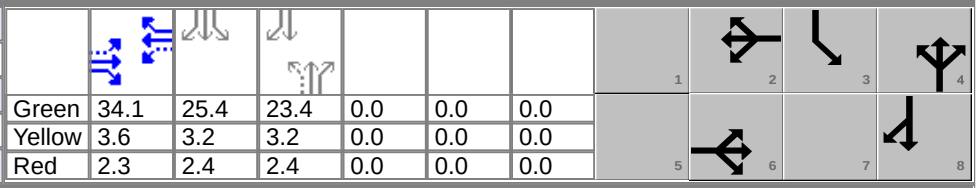
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	River Rd. / 9th St. N	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	RiverRd_9thStN_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	121	163	9	44	274	330	16	520	34	335	453	140

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	34.1	25.4	23.4	0.0	0.0	0.0			
Yellow	3.6	3.2	3.2	0.0	0.0	0.0			
Red	2.3	2.4	2.4	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		6		2		4	3	8
Case Number		6.0		5.0		6.3	2.0	4.0
Phase Duration, s		40.0		40.0		29.0	31.0	60.0
Change Period, *(Y+Rc)*, s		5.9		5.9		5.6	5.6	5.6
Max Allow Headway *(MAH)*, s		0.0		0.0		2.1	2.6	2.1
Queue Clearance Time (g_s), s						19.2	24.5	13.3
Green Extension Time (g_e), s		0.0		0.0		0.6	0.1	0.9
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						0.31	1.00	0.00

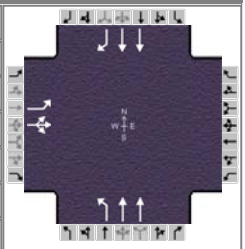
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	132	94	93	48	298	359	17	304	298	364	334	310
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	789	1518	1490	1094	1604	1385	798	1667	1630	1572	1700	1562
Queue Service Time (g_s), s	16.2	4.3	4.4	3.2	15.0	23.0	1.7	17.1	17.2	22.5	11.2	11.3
Cycle Queue Clearance Time (g_c), s	31.2	4.3	4.4	7.6	15.0	23.0	1.7	17.1	17.2	22.5	11.2	11.3
Capacity *(c)*, veh/h	223	518	508	397	547	472	259	390	381	399	925	850
Volume-to-Capacity Ratio *(X)*	0.591	0.181	0.183	0.120	0.545	0.759	0.067	0.779	0.782	0.912	0.362	0.365
Available Capacity (c_a), veh/h	223	518	508	397	547	472	259	390	381	399	925	850
Back of Queue *(Q)*, veh/ln (50th percentile)	3.7	1.6	1.6	0.9	6.1	8.8	0.3	7.7	7.6	11.0	4.0	3.7
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	39.3	23.1	23.2	25.8	26.7	29.3	30.0	35.9	35.9	36.2	12.9	13.0
Incremental Delay (d_2), s/veh	11.0	0.8	0.8	0.6	3.9	10.9	0.0	8.9	9.3	24.3	0.1	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	50.3	23.9	24.0	26.5	30.5	40.2	30.0	44.8	45.2	60.5	13.0	13.1
Level of Service (LOS)	D	C	C	C	C	D	C	D	D	E	B	B
Approach Delay, s/veh / LOS	34.8	C		35.2	D		44.6	D		30.2	C	
Intersection Delay, s/veh / LOS	35.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.4	B
Bicycle LOS Score / LOS	0.8	A	1.6	A	1.0	A	1.3	A

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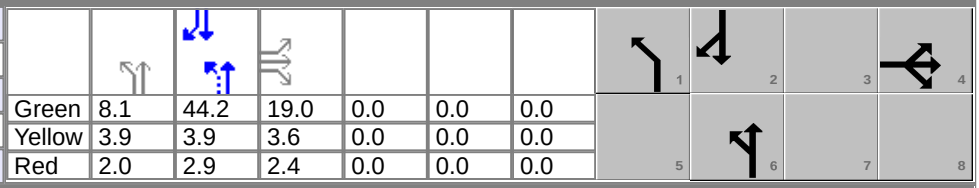
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.87
Intersection	NW Bypass / 3rd St. NW	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	NWBypass_3rdStNW_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	204	0	77				110	290			301	275

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.1	44.2	19.0	0.0	0.0	0.0						
Yellow	3.9	3.9	3.6	0.0	0.0	0.0						
Red	2.0	2.9	2.4	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			1	6		2
Case Number		10.0			1.0	4.0		7.3
Phase Duration, s		25.0			14.0	65.0		51.0
Change Period, *(Y+Rc)*, s		6.0			5.9	6.8		6.8
Max Allow Headway *(MAH)*, s		4.7			4.1	0.0		0.0
Queue Clearance Time *(g_s)*, s		14.0			5.0			
Green Extension Time *(g_e)*, s		0.7			0.1	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		0.89			1.00			

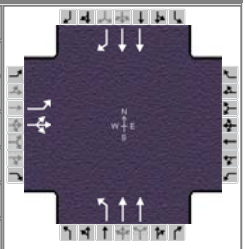
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				1	6			2	12
Adjusted Flow Rate *(v)*, veh/h	234	234					126	333			346	316
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1619					1619	1618			1618	1441
Queue Service Time *(g_s)*, s	12.0	12.0					3.0	3.7			5.5	12.9
Cycle Queue Clearance Time *(g_c)*, s	12.0	12.0					3.0	3.7			5.5	12.9
Capacity *(c)*, veh/h	342	342					564	2093			1590	708
Volume-to-Capacity Ratio *(X)*	0.686	0.686					0.224	0.159			0.218	0.447
Available Capacity *(c_a)*, veh/h	342	342					564	2093			1590	708
Back of Queue *(Q)*, veh/ln (50th percentile)	5.1	5.1					1.0	1.1			1.9	4.3
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0					0.0	0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00					0.00	0.00			0.00	0.00
Uniform Delay *(d_1)*, s/veh	32.7	32.7					8.1	6.3			13.0	14.9
Incremental Delay *(d_2)*, s/veh	5.9	5.9					0.2	0.2			0.3	2.0
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0					0.0	0.0			0.0	0.0
Control Delay *(d)*, s/veh	38.7	38.7					8.3	6.4			13.4	17.0
Level of Service (LOS)	D	D					A	A			B	B
Approach Delay, s/veh / LOS	36.4	D		0.0			6.9	A		15.1	B	
Intersection Delay, s/veh / LOS	17.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	1.9	A	2.3	B
Bicycle LOS Score / LOS	1.0	A			0.9	A	1.0	A

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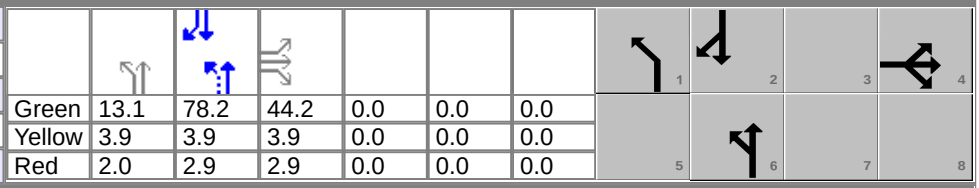
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/12/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	NW Bypass / 3rd St. NW	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	NWBypass_3rdStNW_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	474	0	189				290	749			636	664

Signal Information			
Cycle, s	155.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.1	78.2	44.2	0.0	0.0	0.0		
Yellow	3.9	3.9	3.9	0.0	0.0	0.0		
Red	2.0	2.9	2.9	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			1	6		2
Case Number		10.0			1.0	4.0		7.3
Phase Duration, s		51.0			19.0	104.0		85.0
Change Period, *(Y+Rc)*, s		6.8			5.9	6.8		6.8
Max Allow Headway *(MAH)*, s		4.7			4.1	0.0		0.0
Queue Clearance Time *(g_s)*, s		46.2			15.1			
Green Extension Time *(g_e)*, s		0.0			0.0	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

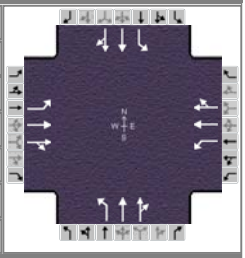
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				1	6			2	12
Adjusted Flow Rate *(v)*, veh/h	515	515					315	814			691	722
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1572	1572					1619	1587			1571	1412
Queue Service Time *(g_s)*, s	44.2	44.2					13.1	19.9			21.7	78.2
Cycle Queue Clearance Time *(g_c)*, s	44.2	44.2					13.1	19.9			21.7	78.2
Capacity *(c)*, veh/h	448	448					324	1990			1585	713
Volume-to-Capacity Ratio *(X)*	1.149	1.149					0.972	0.409			0.436	1.013
Available Capacity *(c_a)*, veh/h	448	448					324	1990			1585	713
Back of Queue *(Q)*, veh/ln (50th percentile)	28.6	28.6					17.1	7.3			8.3	33.5
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0					0.0	0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00					0.00	0.00			0.00	0.00
Uniform Delay *(d_1)*, s/veh	55.4	55.4					27.2	14.5			24.4	38.4
Incremental Delay *(d_2)*, s/veh	90.3	90.3					42.3	0.6			0.9	36.9
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0					0.0	0.0			0.0	0.0
Control Delay *(d)*, s/veh	145.7	145.7					69.5	15.1			25.3	75.3
Level of Service (LOS)	F	F					E	B			C	F
Approach Delay, s/veh / LOS	117.7	F		0.0			30.3	C		50.8	D	
Intersection Delay, s/veh / LOS	58.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	1.9	A	2.3	B
Bicycle LOS Score / LOS	1.7	A			1.4	A	1.7	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 12, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	Central Ave. NW / 6th St. N	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	CentralAveNW_6thStNW_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	40	662	78	141	286	50	78	337	85	108	215	23

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	4.0	40.5	4.0	1.0	19.5	0.0	5	6	7	8
Yellow	3.0	3.2	3.0	0.0	3.2	0.0				
Red	2.0	2.3	2.0	0.0	2.3	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2	7	4	3	8
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	46.0	9.0	46.0	9.0	25.0	10.0	26.0
Change Period, *(Y+Rc)*, s	5.0	5.5	5.0	5.5	5.0	5.5	5.0	5.5
Max Allow Headway *(MAH)*, s	3.6	0.0	3.6	0.0	3.6	3.6	3.6	3.6
Queue Clearance Time *(g_s)*, s	3.3		6.0		5.8	13.8	7.0	8.1
Green Extension Time *(g_e)*, s	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.7
Phase Call Probability	1.00		1.00		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		1.00	0.45	1.00	0.04

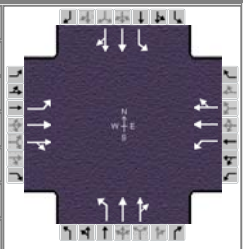
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	43	410	395	153	186	180	85	236	223	117	130	128
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1572	1635	1573	1557	1491	1414	1587	1683	1561	1619	1650	1594
Queue Service Time *(g_s)*, s	1.3	16.6	16.6	4.0	7.0	7.2	3.8	11.5	11.8	5.0	6.0	6.1
Cycle Queue Clearance Time *(g_c)*, s	1.3	16.6	16.6	4.0	7.0	7.2	3.8	11.5	11.8	5.0	6.0	6.1
Capacity *(c)*, veh/h	521	736	708	325	671	636	329	365	338	252	376	363
Volume-to-Capacity Ratio *(X)*	0.083	0.557	0.558	0.472	0.277	0.282	0.257	0.646	0.659	0.467	0.347	0.353
Available Capacity *(c_a)*, veh/h	521	736	708	325	671	636	329	365	338	252	376	363
Back of Queue *(Q)*, veh/ln (50th percentile)	0.4	6.4	6.2	1.7	2.4	2.4	1.4	4.9	4.7	1.9	2.3	2.3
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	12.1	18.2	18.2	17.0	15.5	15.6	26.1	32.1	32.2	26.0	29.1	29.2
Incremental Delay *(d_2)*, s/veh	0.1	3.0	3.2	0.8	1.0	1.1	0.3	3.6	4.3	1.0	0.4	0.4
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	12.2	21.2	21.3	17.7	16.6	16.7	26.4	35.7	36.5	27.0	29.5	29.6
Level of Service (LOS)	B	C	C	B	B	B	C	D	D	C	C	C
Approach Delay, s/veh / LOS	20.8	C		17.0	B		34.6	C		28.8	C	
Intersection Delay, s/veh / LOS	24.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.2	A	0.9	A	0.9	A	0.8	A

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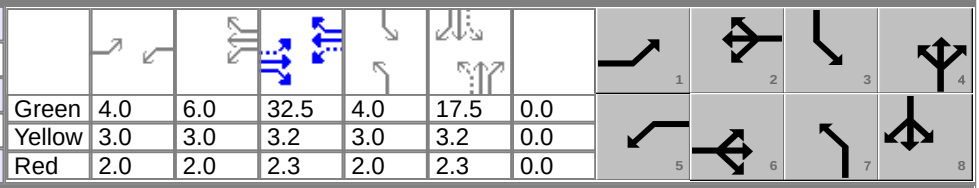
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 12, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	Central Ave. NW / 6th St. N	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	CentralAveNW_6thStNW_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	38	482	97	415	677	153	88	323	90	140	370	30

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.0	6.0	32.5	4.0	17.5	0.0
Yellow	3.0	3.0	3.2	3.0	3.2	0.0
Red	2.0	2.0	2.3	2.0	2.3	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2	7	4	3	8
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	38.0	20.0	49.0	9.0	23.0	9.0	23.0
Change Period, ($Y+R_c$), s	5.0	5.5	5.0	5.5	5.0	5.5	5.0	5.5
Max Allow Headway (*MAH*), s	3.6	0.0	3.6	0.0	3.6	3.6	3.6	3.6
Queue Clearance Time (g_s), s	3.5		13.7		6.0	13.8	6.0	13.0
Green Extension Time (g_e), s	0.0	0.0	0.2	0.0	0.0	1.1	0.0	1.2
Phase Call Probability	1.00		1.00		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		1.00	0.97	1.00	0.76

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate (*v*), veh/h	41	323	306	451	466	436	96	231	218	152	220	215
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1527	1650	1552	1587	1650	1543	1603	1683	1555	1603	1683	1633
Queue Service Time (g_s), s	1.5	14.0	14.1	11.7	18.3	18.3	4.0	11.5	11.8	4.0	10.9	11.0
Cycle Queue Clearance Time (g_c), s	1.5	14.0	14.1	11.7	18.3	18.3	4.0	11.5	11.8	4.0	10.9	11.0
Capacity (*c*), veh/h	314	596	561	507	798	746	221	327	302	211	327	318
Volume-to-Capacity Ratio (*X*)	0.132	0.542	0.546	0.891	0.584	0.585	0.434	0.705	0.721	0.721	0.671	0.677
Available Capacity (c_a), veh/h	314	596	561	507	798	746	221	327	302	211	327	318
Back of Queue (*Q*), veh/ln (50th percentile)	0.5	5.7	5.5	6.8	7.1	6.6	1.7	5.1	5.0	2.2	4.7	4.7
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (*RQ*) (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	16.7	22.8	22.9	15.0	16.7	16.7	29.2	33.8	34.0	34.8	33.6	33.6
Incremental Delay (d_2), s/veh	0.1	3.5	3.8	17.4	3.1	3.3	1.0	6.3	7.7	10.8	4.9	5.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	16.8	26.4	26.7	32.4	19.9	20.1	30.2	40.2	41.7	45.6	38.5	38.9
Level of Service (LOS)	B	C	C	C	B	C	C	D	D	D	D	D
Approach Delay, s/veh / LOS	25.9	C		24.1	C		39.0	D		40.5	D	
Intersection Delay, s/veh / LOS	30.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.0	A	1.6	A	0.9	A	1.0	A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*6th St. SW / 4th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *4th Avenue SW* North/South Street: *6th Street SW*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*227*	*292*	*2*	*316*	*2*
Peak-Hour Factor, PHF	*0.38*	*0.86*	*0.73*	*0.50*	*0.83*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*7*	*263*	*399*	*4*	*380*	*4*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*1*	*7*	*41*	*1*	*4*
Peak-Hour Factor, PHF	*0.25*	*0.25*	*0.88*	*0.60*	*0.25*	*0.33*
Hourly Flow Rate, HFR (veh/h)	*4*	*4*	*7*	*68*	*4*	*12*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*7*	*4*		*84*			*15*	
C (m) (veh/h)	*1186*	*936*		*358*			*419*	
v/c	*0.01*	*0.00*		*0.23*			*0.04*	
95% queue length	*0.02*	*0.01*		*0.90*			*0.11*	
Control Delay (s/veh)	*8.1*	*8.9*		*18.1*			*13.9*	
LOS	*A*	*A*		*C*			*B*	
Approach Delay (s/veh)	--	--	*18.1*			*13.9*		
Approach LOS	--	--	*C*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*6th St. SW / 4th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *4th Avenue SW* North/South Street: *6th Street SW*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*443*	*137*	*4*	*726*	*9*
Peak-Hour Factor, PHF	*0.83*	*0.89*	*0.75*	*0.50*	*0.89*	*0.56*
Hourly Flow Rate, HFR (veh/h)	*12*	*497*	*182*	*8*	*815*	*16*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*2*	*14*	*70*	*1*	*4*
Peak-Hour Factor, PHF	*0.25*	*0.50*	*0.70*	*0.76*	*0.25*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*4*	*4*	*20*	*92*	*4*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

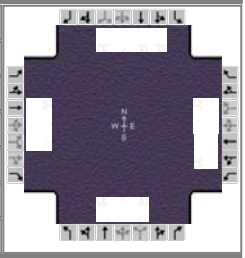
Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*12*	*8*		*104*			*28*	
C (m) (veh/h)	*808*	*923*		*182*			*303*	
v/c	*0.01*	*0.01*		*0.57*			*0.09*	
95% queue length	*0.05*	*0.03*		*3.05*			*0.30*	
Control Delay (s/veh)	*9.5*	*8.9*		*48.3*			*18.1*	
LOS	*A*	*A*		*E*			*C*	
Approach Delay (s/veh)	--	--	*48.3*			*18.1*		
Approach LOS	--	--	*E*			*C*		

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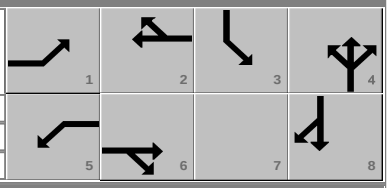
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 29, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.77
Intersection	Central Ave. W / 3rd St. NW	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	16_CentralAveW_3rdStNW_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	102	791	1	50	441	245	2	157	190	488	29	92

Signal Information												
Cycle, s	102.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
				Green	5.1	17.8	14.1	22.0	16.0	0.0		
				Yellow	3.0	3.2	3.0	3.9	3.6	0.0		
				Red	2.0	2.3	2.0	1.6	2.4	0.0		



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4	3	8
Case Number	2.0	4.0	2.0	3.0		5.3	2.0	3.0
Phase Duration, s	19.1	42.4	10.1	33.4		22.0	27.5	49.5
Change Period, *(Y+Rc)*, s	5.5	5.5	5.0	5.5		6.0	5.5	6.0
Max Allow Headway *(MAH)*, s	4.1	4.1	3.2	4.2		4.3	4.2	4.3
Queue Clearance Time *(g_s)*, s	10.5	32.3	6.0	23.6		18.0	22.5	8.3
Green Extension Time *(g_e)*, s	0.0	4.6	0.0	4.3		0.0	0.0	2.5
Phase Call Probability	0.98	1.00	0.84	1.00		1.00	1.00	1.00
Max Out Probability	1.00	0.01	1.00	0.00		1.00	1.00	0.00

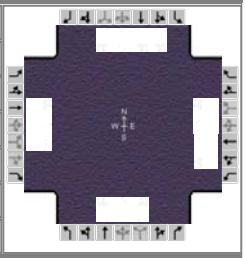
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	132	514	514	65	573	318	3	204	247	634	38	119
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1513	1619	1618	1619	1513	1410	1234	1667	1435	1557	1700	1224
Queue Service Time *(g_s)*, s	8.5	30.3	30.3	4.0	17.3	21.6	0.2	12.0	16.0	20.5	1.3	6.3
Cycle Queue Clearance Time *(g_c)*, s	8.5	30.3	30.3	4.0	17.3	21.6	0.2	12.0	16.0	20.5	1.3	6.3
Capacity *(c)*, veh/h	201	586	586	81	828	386	264	261	225	671	725	522
Volume-to-Capacity Ratio *(X)*	0.657	0.878	0.878	0.802	0.692	0.824	0.010	0.780	1.096	0.944	0.052	0.229
Available Capacity *(c_a)*, veh/h	201	1095	1095	127	1839	857	264	261	225	671	725	522
Back of Queue *(Q)*, veh/ln (50th percentile)	3.6	12.2	12.2	1.8	6.4	3.9	0.1	5.9	11.1	9.8	0.5	0.0
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	42.0	30.4	30.4	48.0	33.2	10.4	36.3	41.3	43.0	39.4	17.2	18.6
Incremental Delay *(d_2)*, s/veh	7.6	4.4	4.4	8.3	1.0	4.5	0.0	14.0	88.1	22.0	0.0	0.2
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	49.6	34.9	34.9	56.3	34.2	14.9	36.4	55.3	131.1	61.4	17.2	18.8
Level of Service (LOS)	D	C	C	E	C	B	D	E	F	E	B	B
Approach Delay, s/veh / LOS	36.5	D		29.3	C		96.5	F		52.9	D	
Intersection Delay, s/veh / LOS	46.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	3.0	C	2.8	C
Bicycle LOS Score / LOS	1.4	A	1.3	A	1.2	A	1.8	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 29, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	Central Ave. W / 3rd St. NW	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	16_CentralAveW_3rdStNW_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	168	617	3	100	1068	696	4	130	79	497	65	191

Signal Information			
Cycle, s	138.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	11.1	47.9	19.0	24.0	9.0	0.0	5	6	7	8
Yellow	3.0	3.2	3.0	3.9	3.6	0.0				
Red	2.0	2.3	2.0	1.6	2.4	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4	3	8
Case Number	2.0	4.0	2.0	3.0		5.3	2.0	3.0
Phase Duration, s	24.0	77.4	16.1	69.5		15.0	29.5	44.5
Change Period, *(Y+Rc)*, s	5.5	5.5	5.0	5.5		6.0	5.5	6.0
Max Allow Headway *(MAH)*, s	4.1	4.1	3.2	4.2		4.4	4.2	4.4
Queue Clearance Time *(g_s)*, s	17.9	19.2	11.2	66.0		11.0	25.7	19.4
Green Extension Time *(g_e)*, s	0.7	3.3	0.0	0.0		0.0	0.0	1.9
Phase Call Probability	1.00	1.00	0.98	1.00		1.00	1.00	1.00
Max Out Probability	0.01	0.01	1.00	1.00		1.00	1.00	0.01

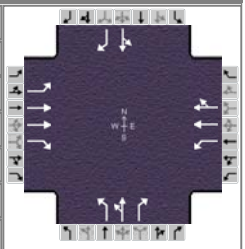
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	183	337	337	109	1161	757	4	141	86	540	71	208
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1557	1635	1632	1603	1602	1441	727	1700	1414	1572	1700	1396
Queue Service Time *(g_s)*, s	15.9	17.2	17.2	9.2	42.1	64.0	0.8	9.0	8.3	23.7	4.3	17.4
Cycle Queue Clearance Time *(g_c)*, s	15.9	17.2	17.2	9.2	42.1	64.0	0.8	9.0	8.3	23.7	4.3	17.4
Capacity *(c)*, veh/h	209	852	850	129	1486	668	100	111	92	547	474	389
Volume-to-Capacity Ratio *(X)*	0.874	0.396	0.396	0.843	0.781	1.133	0.044	1.275	0.931	0.988	0.149	0.533
Available Capacity *(c_a)*, veh/h	462	852	850	163	1486	668	100	111	92	547	474	389
Back of Queue *(Q)*, veh/ln (50th percentile)	6.9	6.7	6.6	4.6	16.7	27.5	0.1	9.3	4.8	12.1	1.8	6.2
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay *(d_1)*, s/veh	58.6	19.9	19.9	62.6	31.1	15.9	60.7	64.5	64.2	56.9	37.4	42.2
Incremental Delay *(d_2)*, s/veh	10.8	0.3	0.3	22.3	2.8	77.4	0.2	176.5	71.4	35.3	0.1	1.4
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay *(d)*, s/veh	69.4	20.2	20.2	84.9	33.9	93.3	60.9	241.0	135.6	92.2	37.6	43.6
Level of Service (LOS)	E	C	C	F	C	F	E	F	F	F	D	D
Approach Delay, s/veh / LOS	30.7	C		58.8	E		198.5	F		75.2	E	
Intersection Delay, s/veh / LOS	64.3						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.6	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.2	A	2.2	B	0.9	A	1.8	A

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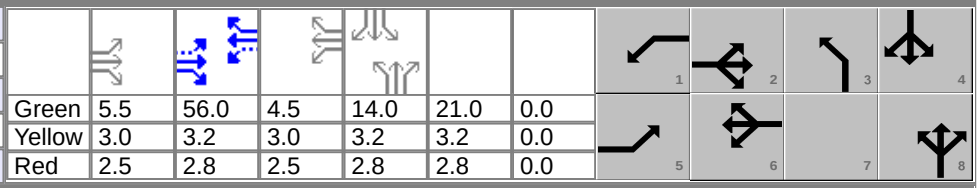
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.79
Intersection	River Dr. / 1st Ave. N	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	18_RiverDr_1stAveN_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	193	899	317	42	525	29	191	84	54	13	76	120

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.5	56.0	4.5	14.0	21.0	0.0
Yellow	3.0	3.2	3.0	3.2	3.2	0.0
Red	2.5	2.8	2.5	2.8	2.8	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.2	3.0	1.3	4.0		9.0		11.0
Phase Duration, s	11.0	73.0	10.0	72.0		27.0		20.0
Change Period, ($Y+R_c$), s	5.5	6.0	6.0	6.0		6.0		6.0
Max Allow Headway (*MAH*), s	3.2	0.0	3.2	0.0		4.2		4.3
Queue Clearance Time (g_s), s	7.5		2.0			21.4		16.0
Green Extension Time (g_e), s	0.0	0.0	0.5	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

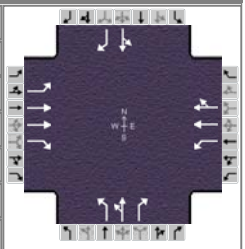
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	244	1138	401	53	354	347	242	106	68		113	152
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1619	1618	1373	1619	1683	1647	1603	1683	1389		1639	1414
Queue Service Time (g_s), s	5.5	34.2	26.0	0.0	17.1	17.1	19.4	7.4	5.6		8.6	14.0
Cycle Queue Clearance Time (g_c), s	5.5	34.2	26.0	0.0	17.1	17.1	19.4	7.4	5.6		8.6	14.0
Capacity (*c*), veh/h	350	1668	708	186	855	836	259	272	224		176	152
Volume-to-Capacity Ratio (*X*)	0.697	0.682	0.567	0.285	0.414	0.415	0.934	0.391	0.305		0.638	0.998
Available Capacity (c_a), veh/h	350	1668	708	186	855	836	259	272	224		176	152
Back of Queue (*Q*), veh/ln (50th percentile)	4.9	13.3	6.4	1.5	7.0	6.9	10.6	3.2	2.0		3.9	8.0
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (*RQ*) (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
Uniform Delay (d_1), s/veh	31.3	23.5	12.0	41.2	20.0	20.0	53.8	48.8	48.1		55.6	58.0
Incremental Delay (d_2), s/veh	5.0	2.3	3.3	0.3	1.5	1.5	38.4	0.9	0.8		7.5	72.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	36.3	25.8	15.3	41.5	21.4	21.5	92.2	49.7	48.8		63.0	130.2
Level of Service (LOS)	D	C	B	D	C	C	F	D	D		E	F
Approach Delay, s/veh / LOS	24.9	C		22.9	C		74.2	E		101.6	F	
Intersection Delay, s/veh / LOS	37.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.5	B	2.3	B	2.9	C	3.1	C
Bicycle LOS Score / LOS	2.0	A	1.1	A	1.2	A	0.9	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Jul 30, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.90
Intersection	River Dr. / 1st Ave. N	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	18_RiverDr_1stAveN_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	165	808	392	78	1230	23	660	109	115	32	114	386

Signal Information			
Cycle, s	165.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

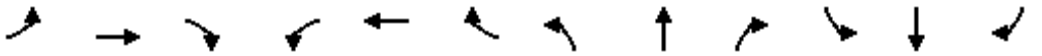
							1	2	3	4
Green	4.5	51.0	7.5	28.0	45.0	0.0	5	6	7	8
Yellow	3.0	3.2	3.0	3.2	3.2	0.0				
Red	2.5	2.8	2.5	2.8	2.8	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.3	3.0	1.2	4.0		9.0		11.0
Phase Duration, s	13.0	70.0	10.0	67.0		51.0		34.0
Change Period, *(Y+Rc)*, s	6.0	6.0	5.5	6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	3.2	0.0	3.2	0.0		4.2		4.4
Queue Clearance Time *(g_s)*, s	9.0		6.5			47.0		30.0
Green Extension Time *(g_e)*, s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

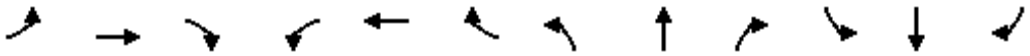
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	183	898	436	87	698	694	733	121	128		162	429
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1618	1396	1619	1700	1687	1619	1683	1426		1665	1415
Queue Service Time *(g_s)*, s	7.0	38.8	45.8	4.5	61.0	61.0	45.0	9.3	11.8		14.8	28.0
Cycle Queue Clearance Time *(g_c)*, s	7.0	38.8	45.8	4.5	61.0	61.0	45.0	9.3	11.8		14.8	28.0
Capacity *(c)*, veh/h	112	1255	542	119	628	624	442	459	389		283	240
Volume-to-Capacity Ratio *(X)*	1.632	0.715	0.804	0.730	1.111	1.113	1.661	0.264	0.328		0.574	1.787
Available Capacity *(c_a)*, veh/h	112	1255	542	119	628	624	442	459	389		283	240
Back of Queue *(Q)*, veh/ln (50th percentile)	14.8	16.2	17.7	2.3	38.2	38.0	56.2	4.0	4.3		6.5	30.3
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
Uniform Delay *(d_1)*, s/veh	77.6	42.8	44.9	52.2	52.0	52.0	60.0	47.0	47.9		63.0	23.4
Incremental Delay *(d_2)*, s/veh	321.1	3.5	12.0	18.0	70.3	71.0	307.3	0.3	0.5		2.8	370.2
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Control Delay *(d)*, s/veh	398.8	46.3	56.9	70.1	122.3	123.0	367.3	47.3	48.4		65.8	393.6
Level of Service (LOS)	F	D	E	E	F	F	F	D	D		E	F
Approach Delay, s/veh / LOS	91.9	F		119.6	F		286.3	F		303.6	F	
Intersection Delay, s/veh / LOS	170.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.3	B	2.9	C	3.1	C
Bicycle LOS Score / LOS	1.7	A	1.7	A	2.1	B	1.5	A

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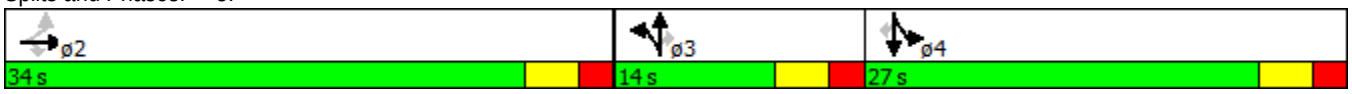
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	564	214	0	0	0	116	22	19	16	68	364
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850						0.850			0.850
Flt Protected		0.996					0.950	0.967		0.950		
Satd. Flow (prot)	0	3154	1417	0	0	0	1504	1531	1417	1583	1667	1417
Flt Permitted		0.996					0.950	0.967		0.950		
Satd. Flow (perm)	0	3154	1417	0	0	0	1504	1531	1417	1583	1667	1417
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			334						102			568
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1038			1127			1081			976	
Travel Time (s)		23.6			25.6			24.6			22.2	
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	72	880	334	0	0	0	181	34	30	25	106	568
Shared Lane Traffic (%)							41%					
Lane Group Flow (vph)	0	952	334	0	0	0	107	108	30	25	106	568
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1				1	2	1	1	2	1
Detector Template	Left	Thru	Right				Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20				20	100	20	20	100	20
Trailing Detector (ft)	0	0	0				0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0				0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20				20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94						94			94	
Detector 2 Size(ft)		6						6			6	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	
Turn Type	Perm	NA	Perm				Split	NA	Perm	Split	NA	Perm
Protected Phases		2					3	3		4	4	
Permitted Phases	2		2						3			4
Detector Phase	2	2	2				3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0				7.0	7.0	7.0	7.0	7.0	7.0

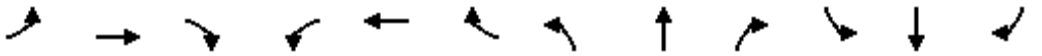


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	21.0	21.0	21.0				12.0	12.0	12.0	12.0	12.0	12.0
Total Split (s)	34.0	34.0	34.0				14.0	14.0	14.0	27.0	27.0	27.0
Total Split (%)	45.3%	45.3%	45.3%				18.7%	18.7%	18.7%	36.0%	36.0%	36.0%
Maximum Green (s)	29.0	29.0	29.0				9.0	9.0	9.0	22.0	22.0	22.0
Yellow Time (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0				2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag							Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	Max				None	None	None	None	None	None
Walk Time (s)	5.0	5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0				11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	2	2	2				3	3	3	0	0	0
Act Effct Green (s)		30.0	30.0				9.7	9.7	9.7	12.3	12.3	12.3
Actuated g/C Ratio		0.47	0.47				0.15	0.15	0.15	0.19	0.19	0.19
v/c Ratio		0.65	0.40				0.47	0.47	0.10	0.08	0.33	0.78
Control Delay		19.0	3.8				34.8	34.5	0.7	22.8	26.5	10.9
Queue Delay		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		19.0	3.8				34.8	34.5	0.7	22.8	26.5	10.9
LOS		B	A				C	C	A	C	C	B
Approach Delay		15.1						30.5			13.7	
Approach LOS		B						C			B	
90th %ile Green (s)	29.0	29.0	29.0				16.0	16.0	16.0	22.0	22.0	22.0
90th %ile Term Code	MaxR	MaxR	MaxR				Ped	Ped	Ped	Max	Max	Max
70th %ile Green (s)	29.0	29.0	29.0				9.0	9.0	9.0	14.8	14.8	14.8
70th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
50th %ile Green (s)	29.0	29.0	29.0				9.0	9.0	9.0	11.2	11.2	11.2
50th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
30th %ile Green (s)	29.0	29.0	29.0				8.4	8.4	8.4	8.8	8.8	8.8
30th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Gap	Gap	Gap
10th %ile Green (s)	29.0	29.0	29.0				0.0	0.0	0.0	7.0	7.0	7.0
10th %ile Term Code	MaxR	MaxR	MaxR				Skip	Skip	Skip	Min	Min	Min
Stops (vph)		505	25				69	70	0	17	62	56
Fuel Used(gal)		11	2				2	2	0	0	1	4
CO Emissions (g/hr)		792	165				113	115	13	23	97	314
NOx Emissions (g/hr)		154	32				22	22	3	4	19	61
VOC Emissions (g/hr)		184	38				26	27	3	5	22	73
Dilemma Vehicles (#)		0	0				0	0	0	0	0	0
Queue Length 50th (ft)		145	0				41	42	0	8	37	0
Queue Length 95th (ft)		239	23				81	82	0	23	68	21
Internal Link Dist (ft)		958			1047			1001			896	
Turn Bay Length (ft)												
Base Capacity (vph)		1474	840				243	248	315	561	591	869
Starvation Cap Reductn		0	0				0	0	0	0	0	0
Spillback Cap Reductn		0	0				0	0	0	0	0	0
Storage Cap Reductn		0	0				0	0	0	0	0	0
Reduced v/c Ratio		0.65	0.40				0.44	0.44	0.10	0.04	0.18	0.65

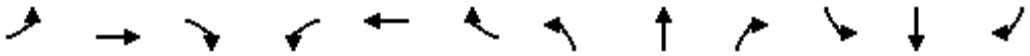
Intersection Summary			
Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 64.2			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 16.3		Intersection LOS: B	
Intersection Capacity Utilization 46.3%		ICU Level of Service A	
Analysis Period (min) 15			
90th %ile Actuated Cycle: 82			
70th %ile Actuated Cycle: 67.8			
50th %ile Actuated Cycle: 64.2			
30th %ile Actuated Cycle: 61.2			
10th %ile Actuated Cycle: 46			

Splits and Phases: 3:





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	617	174	0	0	0	432	20	51	9	43	526
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850						0.850			0.850
Flt Protected		0.996					0.950	0.956		0.950		
Satd. Flow (prot)	0	3154	1417	0	0	0	1504	1514	1417	1583	1667	1417
Flt Permitted		0.996					0.950	0.956		0.950		
Satd. Flow (perm)	0	3154	1417	0	0	0	1504	1514	1417	1583	1667	1417
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			214						102			648
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1038			1127			1081			976	
Travel Time (s)		23.6			25.6			24.6			22.2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	74	760	214	0	0	0	532	25	63	11	53	648
Shared Lane Traffic (%)							48%					
Lane Group Flow (vph)	0	834	214	0	0	0	277	280	63	11	53	648
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1				1	2	1	1	2	1
Detector Template	Left	Thru	Right				Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20				20	100	20	20	100	20
Trailing Detector (ft)	0	0	0				0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0				0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20				20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94						94			94	
Detector 2 Size(ft)		6						6			6	
Detector 2 Type		Cl+Ex						Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0						0.0			0.0	
Turn Type	Perm	NA	Perm				Split	NA	Perm	Split	NA	Perm
Protected Phases		2					3	3		4	4	
Permitted Phases	2		2						3			4
Detector Phase	2	2	2				3	3	3	4	4	4
Switch Phase												
Minimum Initial (s)	15.0	15.0	15.0				7.0	7.0	7.0	7.0	7.0	7.0



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	21.0	21.0	21.0				12.0	12.0	12.0	12.0	12.0	12.0
Total Split (s)	29.0	29.0	29.0				22.0	22.0	22.0	24.0	24.0	24.0
Total Split (%)	38.7%	38.7%	38.7%				29.3%	29.3%	29.3%	32.0%	32.0%	32.0%
Maximum Green (s)	24.0	24.0	24.0				17.0	17.0	17.0	19.0	19.0	19.0
Yellow Time (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0				2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag							Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	Max				None	None	None	None	None	None
Walk Time (s)	5.0	5.0	5.0				5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0				11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	7	7	7				2	2	2	2	2	2
Act Effct Green (s)		24.2	24.2				15.8	15.8	15.8	11.7	11.7	11.7
Actuated g/C Ratio		0.36	0.36				0.24	0.24	0.24	0.18	0.18	0.18
v/c Ratio		0.73	0.33				0.78	0.78	0.15	0.04	0.18	0.83
Control Delay		24.8	4.7				42.8	42.9	3.0	22.2	24.5	12.9
Queue Delay		0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		24.8	4.7				42.8	42.9	3.0	22.2	24.5	12.9
LOS		C	A				D	D	A	C	C	B
Approach Delay		20.7						38.8			13.9	
Approach LOS		C						D			B	
90th %ile Green (s)	24.0	24.0	24.0				17.0	17.0	17.0	19.0	19.0	19.0
90th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Max	Max	Max
70th %ile Green (s)	24.0	24.0	24.0				17.0	17.0	17.0	17.4	17.4	17.4
70th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
50th %ile Green (s)	24.0	24.0	24.0				17.0	17.0	17.0	9.4	9.4	9.4
50th %ile Term Code	MaxR	MaxR	MaxR				Max	Max	Max	Gap	Gap	Gap
30th %ile Green (s)	24.0	24.0	24.0				16.3	16.3	16.3	7.4	7.4	7.4
30th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Gap	Gap	Gap
10th %ile Green (s)	24.0	24.0	24.0				11.6	11.6	11.6	7.0	7.0	7.0
10th %ile Term Code	MaxR	MaxR	MaxR				Gap	Gap	Gap	Min	Min	Min
Stops (vph)		637	26				218	220	5	10	41	76
Fuel Used(gal)		14	2				6	6	1	0	1	7
CO Emissions (g/hr)		973	138				399	404	40	12	60	470
NOx Emissions (g/hr)		189	27				78	79	8	2	12	91
VOC Emissions (g/hr)		226	32				93	94	9	3	14	109
Dilemma Vehicles (#)		0	0				0	0	0	0	0	0
Queue Length 50th (ft)		146	0				105	106	0	4	19	0
Queue Length 95th (ft)		#281	44				#258	#262	13	16	46	#104
Internal Link Dist (ft)		958			1047			1001			896	
Turn Bay Length (ft)												
Base Capacity (vph)		1144	650				386	388	439	454	478	868
Starvation Cap Reductn		0	0				0	0	0	0	0	0
Spillback Cap Reductn		0	0				0	0	0	0	0	0
Storage Cap Reductn		0	0				0	0	0	0	0	0
Reduced v/c Ratio		0.73	0.33				0.72	0.72	0.14	0.02	0.11	0.75

Intersection Summary			
Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 66.8			
Natural Cycle: 55			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 23.4		Intersection LOS: C	
Intersection Capacity Utilization 67.3%		ICU Level of Service C	
Analysis Period (min) 15			
90th %ile Actuated Cycle: 75			
70th %ile Actuated Cycle: 73.4			
50th %ile Actuated Cycle: 65.4			
30th %ile Actuated Cycle: 62.7			
10th %ile Actuated Cycle: 57.6			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3:





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	372	18	62	0	0	87
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.76	0.90	0.71	0.92	0.92	0.75
Hourly flow rate (vph)	489	20	87	0	0	116
Pedestrians	9					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	1					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		999	9	1042	989
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		999	9	1042	989
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	70		49	100	100	33
cM capacity (veh/h)	1623		170	1065	97	172

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	326	183	87	116
Volume Left	326	163	0	0
Volume Right	0	20	0	0
cSH	1623	1623	170	172
Volume to Capacity	0.30	0.30	0.51	0.67
Queue Length 95th (ft)	32	32	64	99
Control Delay (s)	8.2	7.6	46.6	60.7
Lane LOS	A	A	E	F
Approach Delay (s)	7.9		46.6	60.7
Approach LOS			E	F

Intersection Summary			
Average Delay	21.3		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	558	25	79	0	0	100
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.62	0.82	0.92	0.92	0.83
Hourly flow rate (vph)	627	40	96	0	0	120
Pedestrians	2					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		1294	2	1324	1274
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		1294	2	1324	1274
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	61		3	100	100	0
cM capacity (veh/h)	1623		100	1080	12	103

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	418	249	96	120
Volume Left	418	209	0	0
Volume Right	0	40	0	0
cSH	1623	1623	100	103
Volume to Capacity	0.39	0.39	0.97	1.17
Queue Length 95th (ft)	47	47	145	198
Control Delay (s)	8.6	7.8	159.0	221.3
Lane LOS	A	A	F	F
Approach Delay (s)	8.3		159.0	221.3
Approach LOS			F	F

Intersection Summary			
Average Delay	53.7		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*River Dr. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* North/South Street: *River Drive South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*183*	*47*	*115*	*267*	
Peak-Hour Factor, PHF	*1.00*	*0.70*	*0.73*	*0.70*	*0.87*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*261*	*64*	*164*	*306*	*0*
Percent Heavy Vehicles	*0*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration			*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*11*		*104*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.69*	*1.00*	*0.79*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*15*	*0*	*131*
Percent Heavy Vehicles	*0*	*0*	*0*	*18*	*0*	*3*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*164*		*146*				
C (m) (veh/h)		*1240*		*611*				
v/c		*0.13*		*0.24*				
95% queue length		*0.46*		*0.93*				
Control Delay (s/veh)		*8.3*		*12.7*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*12.7*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*River Dr. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* North/South Street: *River Drive South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*161*	*33*	*79*	*331*	
Peak-Hour Factor, PHF	*1.00*	*0.76*	*0.69*	*0.86*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*211*	*47*	*91*	*359*	*0*
Percent Heavy Vehicles	*0*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration			*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*61*		*281*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.59*	*1.00*	*0.59*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*103*	*0*	*476*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*91*		*579*				
C (m) (veh/h)		*1293*		*630*				
v/c		*0.07*		*0.92*				
95% queue length		*0.23*		*11.89*				
Control Delay (s/veh)		*8.0*		*44.4*				
LOS		*A*		*E*				
Approach Delay (s/veh)	--	--	*44.4*					
Approach LOS	--	--	*E*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*2nd St. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* | North/South Street: *2nd Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*153*	*157*			*81*	*25*
Peak-Hour Factor, PHF	*0.71*	*0.77*	*1.00*	*1.00*	*0.81*	*0.69*
Hourly Flow Rate, HFR (veh/h)	*215*	*203*	*0*	*0*	*99*	*36*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*30*		*98*			
Peak-Hour Factor, PHF	*0.83*	*1.00*	*0.77*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*0*	*127*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*4*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*215*						*163*	
C (m) (veh/h)	*1449*						*658*	
v/c	*0.15*						*0.25*	
95% queue length	*0.52*						*0.97*	
Control Delay (s/veh)	*7.9*						*12.3*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--				*12.3*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*2nd St. S / 3rd Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *3rd Avenue South* | North/South Street: *2nd Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*286*	*170*			*219*	*45*
Peak-Hour Factor, PHF	*0.78*	*0.71*	*1.00*	*1.00*	*0.91*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*366*	*239*	*0*	*0*	*240*	*68*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*39*		*114*			
Peak-Hour Factor, PHF	*0.89*	*1.00*	*0.77*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*43*	*0*	*148*	*0*	*0*	*0*
Percent Heavy Vehicles	*3*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*366*						*191*	
C (m) (veh/h)	*1254*						*371*	
v/c	*0.29*						*0.51*	
95% queue length	*1.22*						*2.83*	
Control Delay (s/veh)	*9.0*						*24.6*	
LOS	*A*						*C*	
Approach Delay (s/veh)	--	--				*24.6*		
Approach LOS	--	--				*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / 18th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *18th Avenue SW* | North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*602*	*1*	*4*	*165*	*52*
Peak-Hour Factor, PHF	*0.31*	*0.71*	*0.25*	*0.50*	*0.88*	*0.65*
Hourly Flow Rate, HFR (veh/h)	*16*	*847*	*4*	*8*	*187*	*80*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration	*LTR*			*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*195*	*4*	*12*	*2*	*2*	*13*
Peak-Hour Factor, PHF	*0.81*	*0.50*	*0.75*	*0.50*	*0.50*	*0.54*
Hourly Flow Rate, HFR (veh/h)	*240*	*8*	*16*	*4*	*4*	*24*
Percent Heavy Vehicles	*1*	*0*	*8*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*L*		*LTR*			*LTR*	
v (veh/h)	*16*	*8*		*32*			*264*	
C (m) (veh/h)	*1304*	*796*		*288*			*169*	
v/c	*0.01*	*0.01*		*0.11*			*1.56*	
95% queue length	*0.04*	*0.03*		*0.37*			*17.52*	
Control Delay (s/veh)	*7.8*	*9.6*		*19.1*			*328.8*	
LOS	*A*	*A*		*C*			*F*	
Approach Delay (s/veh)	--	--	*19.1*			*328.8*		
Approach LOS	--	--	*C*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / 18th Ave. SW*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *18th Avenue SW* | North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*310*	*0*	*13*	*612*	*167*
Peak-Hour Factor, PHF	*0.75*	*0.83*	*0.25*	*0.54*	*0.92*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*4*	*373*	*0*	*24*	*665*	*198*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration	*LTR*			*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*76*	*3*	*6*	*0*	*0*	*3*
Peak-Hour Factor, PHF	*0.79*	*0.38*	*0.50*	*0.25*	*0.25*	*0.38*
Hourly Flow Rate, HFR (veh/h)	*96*	*7*	*12*	*0*	*0*	*7*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*L*		*LTR*			*LTR*	
v (veh/h)	*4*	*24*		*7*			*115*	
C (m) (veh/h)	*788*	*1193*		*673*			*171*	
v/c	*0.01*	*0.02*		*0.01*			*0.67*	
95% queue length	*0.02*	*0.06*		*0.03*			*3.94*	
Control Delay (s/veh)	*9.6*	*8.1*		*10.4*			*61.0*	
LOS	*A*	*A*		*B*			*F*	
Approach Delay (s/veh)	--	--	*10.4*			*61.0*		
Approach LOS	--	--	*B*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / Park Garden Rd.*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Park Garden Road* North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*13*	*415*	*1*	*11*	*104*	*30*
Peak-Hour Factor, PHF	*0.81*	*0.79*	*0.25*	*0.31*	*0.59*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*16*	*525*	*4*	*35*	*176*	*40*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*102*	*3*	*5*	*1*	*8*	*36*
Peak-Hour Factor, PHF	*0.75*	*0.75*	*0.63*	*0.25*	*0.40*	*0.53*
Hourly Flow Rate, HFR (veh/h)	*136*	*4*	*7*	*4*	*19*	*67*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*35*		*90*			*147*	
C (m) (veh/h)	*1343*	*1047*		*441*			*222*	
v/c	*0.01*	*0.03*		*0.20*			*0.66*	
95% queue length	*0.04*	*0.10*		*0.76*			*4.09*	
Control Delay (s/veh)	*7.7*	*8.6*		*15.2*			*48.2*	
LOS	*A*	*A*		*C*			*E*	
Approach Delay (s/veh)	--	--	*15.2*			*48.2*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/18/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*Fox Farm Rd. / Park Garden Rd.*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Park Garden Road* North/South Street: *Fox Farm Road*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*195*	*5*	*46*	*391*	*130*
Peak-Hour Factor, PHF	*0.75*	*0.73*	*0.31*	*0.72*	*0.84*	*0.77*
Hourly Flow Rate, HFR (veh/h)	*24*	*267*	*16*	*63*	*465*	*168*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*69*	*6*	*25*	*6*	*8*	*27*
Peak-Hour Factor, PHF	*0.75*	*0.50*	*0.69*	*0.50*	*0.40*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*92*	*12*	*36*	*12*	*19*	*39*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*24*	*63*		*70*			*140*	
C (m) (veh/h)	*958*	*1287*		*321*			*213*	
v/c	*0.03*	*0.05*		*0.22*			*0.66*	
95% queue length	*0.08*	*0.15*		*0.82*			*4.00*	
Control Delay (s/veh)	*8.9*	*7.9*		*19.3*			*49.4*	
LOS	*A*	*A*		*C*			*E*	
Approach Delay (s/veh)	--	--	*19.3*			*49.4*		
Approach LOS	--	--	*C*			*E*		

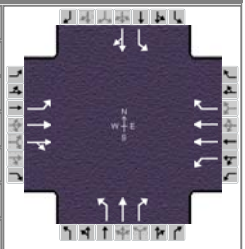
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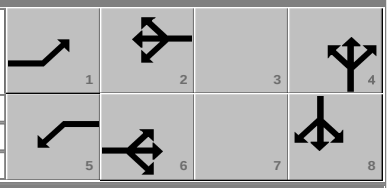
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 1, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 2nd St.	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_2ndSt_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	107	1275	0	25	587	230	44	3	210	69	3	33

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.7	1.0	80.0	25.5	0.0	0.0
Yellow	3.6	0.0	3.6	4.0	0.0	0.0
Red	1.7	0.0	2.4	2.5	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4		8
Case Number	1.1	4.0	1.1	3.0		5.0		6.0
Phase Duration, s	12.0	87.0	11.0	86.0		32.0		32.0
Change Period, *(Y+Rc)*, s	6.3	6.0	5.3	6.0		6.5		6.5
Max Allow Headway *(MAH)*, s	4.1	0.0	1.1	0.0		4.4		4.4
Queue Clearance Time (g_s), s	5.4		2.8			22.1		9.4
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.5		1.4
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		0.00			1.00		0.01

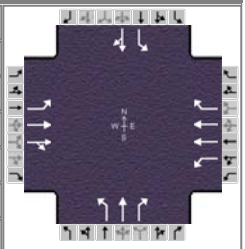
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	116	1386	0	27	638	250	48	3	228	75	39	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1603	1650	0	1619	1571	1441	1311	1700	1412	1167	1459	
Queue Service Time (g_s), s	3.4	35.5	0.0	0.8	12.7	10.5	4.1	0.2	20.1	7.2	2.9	
Cycle Queue Clearance Time (g_c), s	3.4	35.5	0.0	0.8	12.7	10.5	6.9	0.2	20.1	7.4	2.9	
Capacity *(c)*, veh/h	451	2057		265	1934	887	284	333	277	283	286	
Volume-to-Capacity Ratio *(X)*	0.258	0.674	0.000	0.102	0.330	0.282	0.169	0.010	0.824	0.265	0.137	
Available Capacity (c_a), veh/h	451	2057		265	1934	887	284	333	277	283	286	
Back of Queue *(Q)*, veh/ln (50th percentile)	1.1	13.0		0.3	4.4	3.5	1.3	0.1	8.4	2.1	1.1	
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Uniform Delay (d_1), s/veh	8.7	15.9		12.6	12.1	11.6	46.0	42.1	50.1	45.1	43.2	
Incremental Delay (d_2), s/veh	0.3	1.8	0.0	0.1	0.5	0.8	0.3	0.0	17.9	0.5	0.2	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay *(d)*, s/veh	9.0	17.7		12.6	12.5	12.4	46.3	42.1	68.0	45.6	43.4	
Level of Service (LOS)	A	B		B	B	B	D	D	E	D	D	
Approach Delay, s/veh / LOS	17.0	B		12.5	B		64.0	E		44.8	D	
Intersection Delay, s/veh / LOS	21.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.2	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.7	A	1.2	A	0.9	A	0.7	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 1, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 2nd St.	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_2ndSt_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	56	1139	0	63	1819	324	65	3	222	182	17	243

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.7	5.7	78.0	21.5	0.0	0.0	5	6	7	8
Yellow	3.6	3.0	3.6	4.0	0.0	0.0				
Red	1.7	3.3	2.4	2.5	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		4		8
Case Number	1.1	4.0	1.1	3.0		5.0		6.0
Phase Duration, s	23.0	96.0	11.0	84.0		28.0		28.0
Change Period, *(Y+Rc)*, s	6.3	6.0	5.3	6.0		6.5		6.5
Max Allow Headway *(MAH)*, s	4.1	0.0	1.1	0.0		4.5		4.5
Queue Clearance Time *(g_s)*, s	3.0		4.3			23.5		23.5
Green Extension Time *(g_e)*, s	0.1	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.46			1.00		1.00

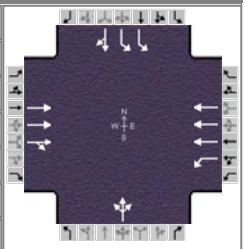
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14	3	8	18
Adjusted Flow Rate *(v)*, veh/h	61	1238	0	68	1977	352	71	3	241	198	283	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1667	0	1587	1602	1441	1081	1700	1421	1142	1455	
Queue Service Time *(g_s)*, s	1.0	26.6	0.0	2.3	78.0	18.4	0.0	0.2	21.5	21.3	21.5	
Cycle Queue Clearance Time *(g_c)*, s	1.0	26.6	0.0	2.3	78.0	18.4	21.5	0.2	21.5	21.5	21.5	
Capacity *(c)*, veh/h	254	2222		331	1852	832	53	271	226	233	232	
Volume-to-Capacity Ratio *(X)*	0.240	0.557	0.000	0.207	1.068	0.423	1.325	0.012	1.066	0.848	1.219	
Available Capacity *(c_a)*, veh/h	254	2222		331	1852	832	53	271	226	233	232	
Back of Queue *(Q)*, veh/ln (50th percentile)	1.4	9.5		0.8	38.6	6.3	5.3	0.1	12.6	8.4	16.3	
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Uniform Delay *(d_1)*, s/veh	34.0	11.9		11.1	28.5	15.9	67.5	47.8	56.8	57.8	56.8	
Incremental Delay *(d_2)*, s/veh	0.5	1.0	0.0	0.1	41.7	1.6	232.6	0.0	78.4	24.2	131.2	
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay *(d)*, s/veh	34.5	12.9		11.2	70.2	17.5	300.1	47.8	135.1	82.0	188.0	
Level of Service (LOS)	C	B		B	F	B	F	D	F	F	F	
Approach Delay, s/veh / LOS	14.0	B		60.8	E		171.2	F		144.3	F	
Intersection Delay, s/veh / LOS	63.9						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.3	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.6	A	2.5	B	1.0	A	1.3	A

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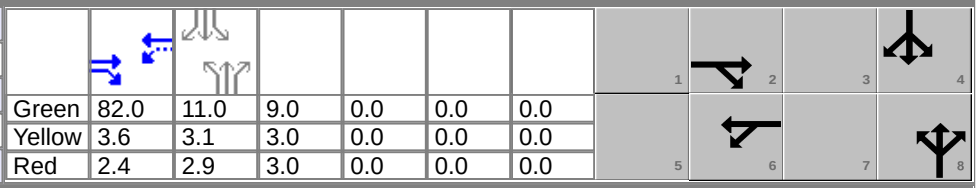
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 7, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.88
Intersection	10th Ave. S / 5th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_5thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1560	19	16	1054		48	0	22	120	37	58

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	82.0	11.0	9.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		10.0
Phase Duration, s		88.0		88.0		15.0		17.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.2		4.2
Queue Clearance Time *(g_s)*, s						8.0		10.8
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

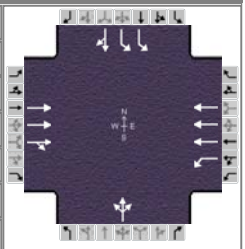
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1199	596	18	1198			80		136	108	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1650	1640	267	1484			1556		1456	1451	
Queue Service Time *(g_s)*, s		21.7	21.7	4.4	14.0			6.0		5.4	8.8	
Cycle Queue Clearance Time *(g_c)*, s		21.7	21.7	26.0	14.0			6.0		5.4	8.8	
Capacity *(c)*, veh/h		2256	1121	194	3043			117		267	133	
Volume-to-Capacity Ratio *(X)*		0.531	0.532	0.094	0.394			0.681		0.511	0.812	
Available Capacity *(c_a)*, veh/h		2256	1121	194	3043			117		267	133	
Back of Queue *(Q)*, veh/ln (50th percentile)		7.3	7.5	0.3	4.2			2.8		2.0	4.3	
Overflow Queue *(Q_3)*, veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	
Uniform Delay *(d_1)*, s/veh		9.4	9.4	15.9	8.2			54.1		51.9	53.5	
Incremental Delay *(d_2)*, s/veh		0.9	1.8	1.0	0.4			15.0		1.6	30.3	
Initial Queue Delay *(d_3)*, s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Control Delay *(d)*, s/veh		10.3	11.3	16.9	8.6			69.1		53.6	83.8	
Level of Service (LOS)		B	B	B	A			E		D	F	
Approach Delay, s/veh / LOS	10.6	B		8.7	A		69.1	E		66.9	E	
Intersection Delay, s/veh / LOS	15.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.5	A	1.2	A	0.6	A	0.9	A

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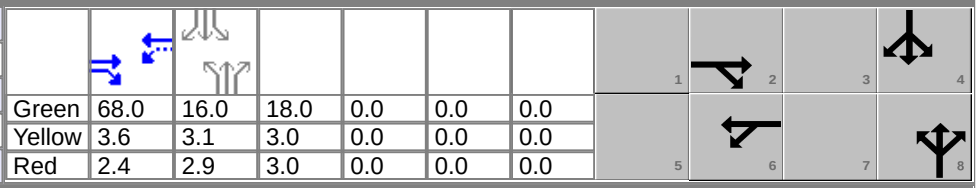
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 7, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.90
Intersection	10th Ave. S / 5th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_5thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1589	27	35	1917		167	0	53	259	51	136

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	68.0	16.0	18.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		10.0
Phase Duration, s		74.0		74.0		24.0		22.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.2		4.2
Queue Clearance Time *(g_s)*, s						20.0		18.0
Green Extension Time *(g_e)*, s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

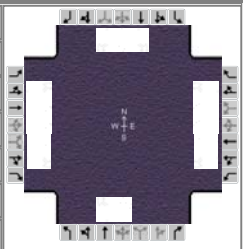
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1200	595	39	2130			244		288	208	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1683	1668	267	1513			1567		1541	1474	
Queue Service Time *(g_s)*, s		28.8	28.8	13.8	46.0			18.0		10.7	16.0	
Cycle Queue Clearance Time *(g_c)*, s		28.8	28.8	42.6	46.0			18.0		10.7	16.0	
Capacity *(c)*, veh/h		1908	945	147	2573			235		411	197	
Volume-to-Capacity Ratio *(X)*		0.629	0.630	0.264	0.828			1.040		0.700	1.057	
Available Capacity *(c_a)*, veh/h		1908	945	147	2573			235		411	197	
Back of Queue *(Q)*, veh/ln (50th percentile)		11.0	11.3	1.1	15.9			11.5		4.4	10.2	
Overflow Queue *(Q_3)*, veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	
Uniform Delay *(d_1)*, s/veh		17.5	17.5	31.9	21.2			51.0		49.7	52.0	
Incremental Delay *(d_2)*, s/veh		1.6	3.2	4.3	3.2			69.5		5.2	80.2	
Initial Queue Delay *(d_3)*, s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Control Delay *(d)*, s/veh		19.1	20.7	36.2	24.5			120.5		54.9	132.2	
Level of Service (LOS)		B	C	D	C			F		D	F	
Approach Delay, s/veh / LOS	19.6	B		24.7	C		120.5	F		87.3	F	
Intersection Delay, s/veh / LOS	34.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.5	A	1.7	A	0.9	A	1.3	A

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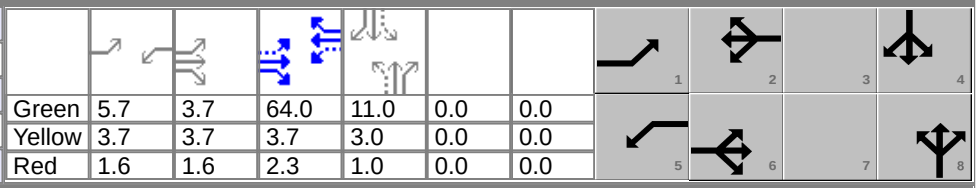
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.80
Intersection	10th Ave. S / 9th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_9thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	128	1437	49	24	1105	162	62	30	18	138	41	96

Signal Information			
Cycle, s	105.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.7	3.7	64.0	11.0	0.0	0.0
Yellow	3.7	3.7	3.7	3.0	0.0	0.0
Red	1.6	1.6	2.3	1.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	3.0	1.1	3.0		6.0		5.0
Phase Duration, s	20.0	79.0	11.0	70.0		15.0		15.0
Change Period, *(Y+Rc)*, s	5.3	6.0	5.3	6.0		4.0		4.0
Max Allow Headway *(MAH)*, s	1.1	0.0	1.1	0.0		1.3		1.3
Queue Clearance Time (g_s), s	3.7		2.7			11.4		13.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.00			1.00		1.00

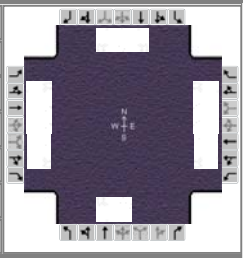
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	160	1796	61	30	1381	203	78	60		173	51	120
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1544	1441	1619	1544	1441	1233	1593		1364	1700	1441
Queue Service Time (g_s), s	1.7	20.3	1.4	0.7	17.4	6.7	6.5	3.7		7.3	2.9	8.5
Cycle Queue Clearance Time (g_c), s	1.7	20.3	1.4	0.7	17.4	6.7	9.4	3.7		11.0	2.9	8.5
Capacity *(c)*, veh/h	441	3220	1002	283	2823	878	163	167		164	178	151
Volume-to-Capacity Ratio *(X)*	0.363	0.558	0.061	0.106	0.489	0.231	0.474	0.360		1.054	0.288	0.795
Available Capacity (c_a), veh/h	441	3220	1002	283	2823	878	163	167		164	178	151
Back of Queue *(Q)*, veh/ln (50th percentile)	1.5	5.8	0.4	0.2	5.6	2.1	2.0	1.5		8.1	1.2	4.0
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh	8.8	8.0	5.1	6.7	11.4	9.3	47.7	43.7		50.4	43.4	45.9
Incremental Delay (d_2), s/veh	0.2	0.7	0.1	0.1	0.6	0.6	0.8	0.5		85.4	0.3	23.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	8.9	8.7	5.2	6.8	12.0	9.9	48.5	44.2		135.8	43.7	69.0
Level of Service (LOS)	A	A	A	A	B	A	D	D		F	D	E
Approach Delay, s/veh / LOS	8.6	A		11.7	B		46.6	D		98.7	F	
Intersection Delay, s/veh / LOS	18.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	3.4	C	3.4	C
Bicycle LOS Score / LOS	1.6	A	1.4	A	0.7	A	1.1	A

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HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.95
Intersection	10th Ave. S / 9th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_9thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	1563	133	61	1690	207	185	81	59	325	89	203

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.7	2.7	42.0	24.0	0.0	0.0	5	6	7	8
Yellow	3.7	3.7	3.7	3.0	0.0	0.0				
Red	1.6	1.6	2.3	1.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	3.0	1.1	3.0		6.0		5.0
Phase Duration, s	19.0	56.0	11.0	48.0		28.0		28.0
Change Period, $(Y+R_c)$, s	5.3	6.0	5.3	6.0		4.0		4.0
Max Allow Headway *(MAH)*, s	1.1	0.0	1.1	0.0		1.4		1.4
Queue Clearance Time (g_s), s	5.4		4.0			22.7		26.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.1		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.15			1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	168	1645	140	64	1779	218	195	147		342	94	214
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1603	1513	1426	1619	1513	1441	1078	1580		1260	1700	1426
Queue Service Time (g_s), s	3.4	25.6	4.9	2.0	34.1	9.4	16.6	7.3		16.7	4.1	12.5
Cycle Queue Clearance Time (g_c), s	3.4	25.6	4.9	2.0	34.1	9.4	20.7	7.3		24.0	4.1	12.5
Capacity *(c)*, veh/h	325	2389	751	242	2007	637	301	399		297	429	360
Volume-to-Capacity Ratio *(X)*	0.518	0.689	0.186	0.265	0.886	0.342	0.647	0.369		1.151	0.218	0.593
Available Capacity (c_a), veh/h	325	2389	751	242	2007	637	301	399		297	429	360
Back of Queue *(Q)*, veh/ln (50th percentile)	2.0	8.4	1.6	0.7	12.5	3.2	4.5	2.7		15.1	1.7	4.4
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh	18.9	16.7	11.8	14.4	24.3	17.4	36.3	29.3		41.3	28.1	31.2
Incremental Delay (d_2), s/veh	0.7	1.6	0.5	0.2	6.2	1.5	3.7	0.2		99.4	0.1	1.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh	19.5	18.4	12.4	14.6	30.5	18.9	40.0	29.5		140.7	28.2	33.0
Level of Service (LOS)	B	B	B	B	C	B	D	C		F	C	C
Approach Delay, s/veh / LOS	18.0	B		28.8	C		35.5	D		89.0	F	
Intersection Delay, s/veh / LOS	32.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.4	B	3.4	C	3.4	C
Bicycle LOS Score / LOS	1.6	A	1.6	A	1.1	A	1.6	A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*13th Ave. S / 9th St.S*
Jurisdiction	*Great Falls*
Analysis Year	*Existing - 2013*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* North/South Street: *9th Street South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*112*	*18*	*28*	*167*	*41*
Peak-Hour Factor, PHF	*0.63*	*0.70*	*0.64*	*0.54*	*0.67*	*0.60*
Hourly Flow Rate, HFR (veh/h)	*7*	*160*	*28*	*51*	*249*	*68*
Percent Heavy Vehicles	*0*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*8*	*34*	*6*	*15*	*31*	*18*
Peak-Hour Factor, PHF	*0.67*	*0.71*	*0.75*	*0.54*	*0.71*	*0.56*
Hourly Flow Rate, HFR (veh/h)	*11*	*47*	*8*	*27*	*43*	*32*
Percent Heavy Vehicles	*0*	*3*	*17*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*7*	*51*		*102*			*66*	
C (m) (veh/h)	*1255*	*1370*		*457*			*409*	
v/c	*0.01*	*0.04*		*0.22*			*0.16*	
95% queue length	*0.02*	*0.12*		*0.85*			*0.57*	
Control Delay (s/veh)	*7.9*	*7.7*		*15.1*			*15.5*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*15.1*			*15.5*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*13th Ave. S / 9th St.S*
Jurisdiction	*Great Falls*
Analysis Year	*Existing - 2013*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* | North/South Street: *9th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*13*	*181*	*35*	*64*	*115*	*82*
Peak-Hour Factor, PHF	*0.81*	*0.91*	*0.80*	*0.62*	*0.87*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*16*	*198*	*43*	*103*	*132*	*100*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*27*	*69*	*10*	*14*	*87*	*42*
Peak-Hour Factor, PHF	*0.68*	*0.82*	*0.50*	*0.58*	*0.78*	*0.70*
Hourly Flow Rate, HFR (veh/h)	*39*	*84*	*20*	*24*	*111*	*60*
Percent Heavy Vehicles	*4*	*0*	*0*	*0*	*1*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

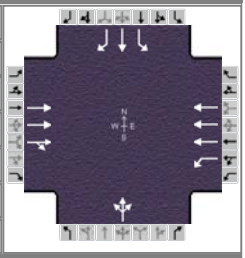
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*103*		*195*			*143*	
C (m) (veh/h)	*1348*	*1319*		*389*			*317*	
v/c	*0.01*	*0.08*		*0.50*			*0.45*	
95% queue length	*0.04*	*0.25*		*2.71*			*2.24*	
Control Delay (s/veh)	*7.7*	*8.0*		*23.2*			*25.4*	
LOS	*A*	*A*		*C*			*D*	
Approach Delay (s/veh)	--	--	*23.2*			*25.4*		
Approach LOS	--	--	*C*			*D*		

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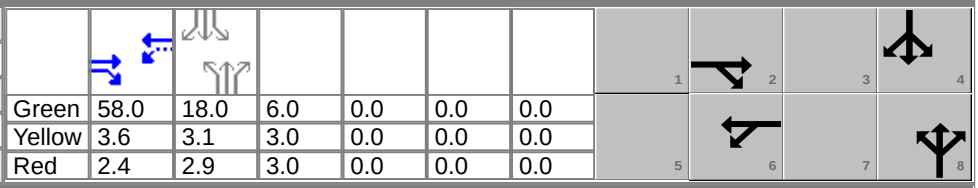
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/8/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.82
Intersection	10th Ave. S / 14th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_14thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1204	29	22	1240		7	0	9	157	97	177

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	58.0	18.0	6.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		9.0
Phase Duration, s		64.0		64.0		12.0		24.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		3.3		3.2
Queue Clearance Time (g_s), s						3.2		17.1
Green Extension Time (g_e), s		0.0		0.0		0.0		0.1
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

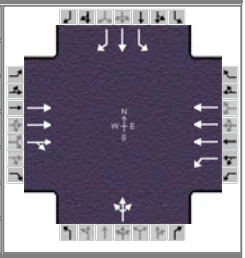
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1007	497	27	1512			20		191	118	216
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1650	1629	354	1499			1509		1619	1683	1385
Queue Service Time (g_s), s		18.4	18.4	5.0	21.3			1.2		11.0	6.2	15.1
Cycle Queue Clearance Time (g_c), s		18.4	18.4	23.4	21.3			1.2		11.0	6.2	15.1
Capacity *(c)*, veh/h		1915	945	212	2608			91		291	303	249
Volume-to-Capacity Ratio *(X)*		0.526	0.526	0.126	0.580			0.215		0.657	0.390	0.866
Available Capacity (c_a), veh/h		1915	945	212	2608			91		291	303	249
Back of Queue *(Q)*, veh/ln (50th percentile)		6.5	6.7	0.5	6.7			0.5		4.6	2.5	6.7
Overflow Queue (Q_3), veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		12.7	12.7	19.8	13.3			44.8		38.1	36.2	39.8
Incremental Delay (d_2), s/veh		1.0	2.1	1.2	0.9			0.4		4.2	0.3	24.8
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		13.7	14.8	21.0	14.2			45.2		42.4	36.5	64.7
Level of Service (LOS)		B	B	C	B			D		D	D	E
Approach Delay, s/veh / LOS	14.1	B		14.4	B		45.2	D		50.2	D	
Intersection Delay, s/veh / LOS	19.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.3	A	1.3	A	0.5	A	1.4	A

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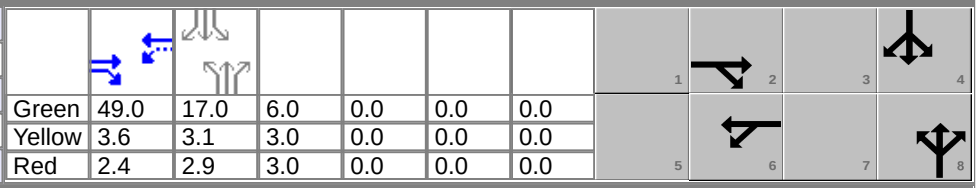
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/8/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.95
Intersection	10th Ave. S / 14th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_14thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1780	41	28	1683		33	0	35	263	160	224

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	49.0	17.0	6.0	0.0	0.0	0.0						
Yellow	3.6	3.1	3.0	0.0	0.0	0.0						
Red	2.4	2.9	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		6.0		12.0		9.0
Phase Duration, s		55.0		55.0		12.0		23.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.3		4.2
Queue Clearance Time (g_s), s						6.1		17.1
Green Extension Time (g_e), s		0.0		0.0		0.0		0.0
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

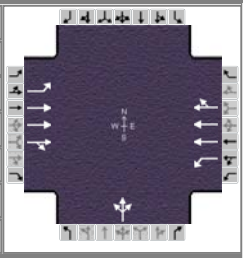
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1283	634	29	1772			72		277	168	236
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1683	1662	237	1499			1522		1619	1650	1390
Queue Service Time (g_s), s		25.2	25.3	9.4	26.7			4.1		15.1	8.3	14.9
Cycle Queue Clearance Time (g_c), s		25.2	25.3	34.7	26.7			4.1		15.1	8.3	14.9
Capacity *(c)*, veh/h		1833	905	143	2448			101		306	312	263
Volume-to-Capacity Ratio *(X)*		0.700	0.701	0.207	0.724			0.705		0.905	0.540	0.898
Available Capacity (c_a), veh/h		1833	905	143	2448			101		306	312	263
Back of Queue *(Q)*, veh/ln (50th percentile)		9.1	9.6	0.6	8.5			2.1		8.2	3.4	7.1
Overflow Queue (Q_3), veh/ln		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00	0.00	0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		15.1	15.1	27.9	15.4			41.1		35.7	33.0	35.7
Incremental Delay (d_2), s/veh		2.3	4.5	3.3	1.9			19.9		28.6	1.9	30.5
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		17.3	19.6	31.1	17.3			61.0		64.4	34.8	66.2
Level of Service (LOS)		B	B	C	B			E		E	C	E
Approach Delay, s/veh / LOS	18.1	B		17.5	B		61.0	E		57.7	E	
Intersection Delay, s/veh / LOS	24.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.5	A	1.5	A	0.6	A	1.6	A

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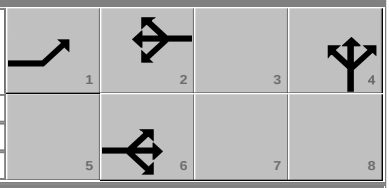
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.85
Intersection	10th Ave. S / 15th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_15thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	136	1309	10	4	1250	164	23	73	12			

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.4	81.2	11.6	0.0	0.0	0.0						
Yellow	3.6	3.6	3.0	0.0	0.0	0.0						
Red	1.2	2.4	3.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		4		
Case Number	1.0	4.0		6.3		12.0		
Phase Duration, s	10.2	97.4		87.2		17.6		
Change Period, *(Y+Rc)*, s	4.8	6.0		6.0		6.0		
Max Allow Headway *(MAH)*, s	4.1	0.0		0.0		3.1		
Queue Clearance Time *(g_s)*, s	5.0					10.8		
Green Extension Time *(g_e)*, s	0.4	0.0		0.0		0.1		
Phase Call Probability	0.99					0.98		
Max Out Probability	0.00					0.00		

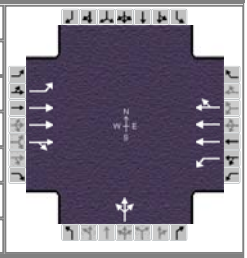
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14			
Adjusted Flow Rate *(v)*, veh/h	160	1036	516	5	1132	531		127				
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1572	1650	1644	338	1683	1578		1616				
Queue Service Time *(g_s)*, s	3.0	10.8	10.8	0.5	17.1	17.2		8.8				
Cycle Queue Clearance Time *(g_c)*, s	3.0	10.8	10.8	1.1	17.1	17.2		8.8				
Capacity *(c)*, veh/h	300	2623	1306	300	2377	1114		163				
Volume-to-Capacity Ratio *(X)*	0.533	0.395	0.395	0.016	0.476	0.477		0.778				
Available Capacity *(c_a)*, veh/h	494	2623	1306	300	2377	1114		281				
Back of Queue *(Q)*, veh/ln (50th percentile)	0.9	2.8	2.9	0.0	5.6	5.5		3.7				
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00				
Uniform Delay *(d_1)*, s/veh	6.9	3.5	3.5	5.2	7.5	7.5		50.4				
Incremental Delay *(d_2)*, s/veh	1.5	0.4	0.9	0.1	0.7	1.5		3.0				
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Control Delay *(d)*, s/veh	8.3	4.0	4.4	5.3	8.2	9.0		53.4				
Level of Service (LOS)	A	A	A	A	A	A		D				
Approach Delay, s/veh / LOS	4.5	A		8.4	A		53.4	D		0.0		
Intersection Delay, s/veh / LOS	8.1						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.0	B	1.9	A	3.3	C	3.3	C
Bicycle LOS Score / LOS	1.4	A	1.4	A	0.7	A		

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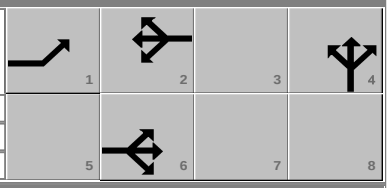
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.97
Intersection	10th Ave. S / 15th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_15thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	261	1890	46	23	1698	290	47	165	13			

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.7	55.1	16.4	0.0	0.0	0.0			
Yellow	3.6	3.6	3.0	0.0	0.0	0.0			
Red	1.2	2.4	3.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		4		
Case Number	1.0	4.0		6.3		12.0		
Phase Duration, s	16.5	77.6		61.1		22.4		
Change Period, *(Y+Rc)*, s	4.8	6.0		6.0		6.0		
Max Allow Headway *(MAH)*, s	4.1	0.0		0.0		3.1		
Queue Clearance Time *(g_s)*, s	10.9					15.5		
Green Extension Time *(g_e)*, s	0.8	0.0		0.0		0.4		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.00					0.00		

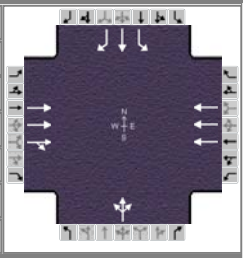
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7	4	14			
Adjusted Flow Rate *(v)*, veh/h	269	1336	660	24	1397	652		232				
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1603	1683	1662	220	1700	1568		1665				
Queue Service Time *(g_s)*, s	8.9	18.7	18.8	5.7	31.4	32.0		13.5				
Cycle Queue Clearance Time *(g_c)*, s	8.9	18.7	18.8	8.0	31.4	32.0		13.5				
Capacity *(c)*, veh/h	307	2409	1189	188	1872	863		274				
Volume-to-Capacity Ratio *(X)*	0.877	0.554	0.555	0.126	0.746	0.756		0.847				
Available Capacity *(c_a)*, veh/h	548	2409	1189	188	1872	863		549				
Back of Queue *(Q)*, veh/ln (50th percentile)	6.9	5.6	5.9	0.3	11.8	11.9		5.6				
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00				
Uniform Delay *(d_1)*, s/veh	25.1	6.7	6.7	12.5	17.1	17.3		40.6				
Incremental Delay *(d_2)*, s/veh	7.9	0.9	1.9	1.4	2.8	6.1		2.8				
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0				
Control Delay *(d)*, s/veh	32.9	7.6	8.6	13.9	19.9	23.4		43.4				
Level of Service (LOS)	C	A	A	B	B	C		D				
Approach Delay, s/veh / LOS	10.9	B		20.9	C		43.4	D		0.0		
Intersection Delay, s/veh / LOS	17.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.0	B	1.9	A	3.3	C	3.3	C
Bicycle LOS Score / LOS	1.7	A	1.6	A	0.9	A		

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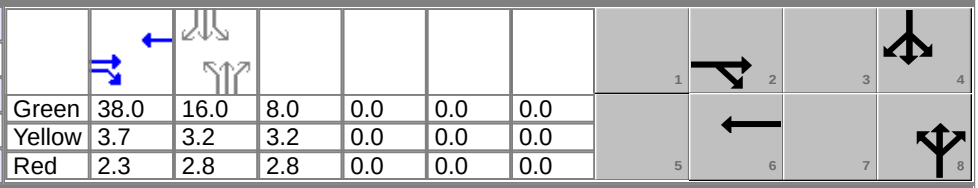
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 25th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_25thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1177	18		1171		13	0	13	257	127	183

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	38.0	16.0	8.0	0.0	0.0	0.0						
Yellow	3.7	3.2	3.2	0.0	0.0	0.0						
Red	2.3	2.8	2.8	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		12.0		9.0
Phase Duration, s		44.0		44.0		14.0		22.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.3		4.2
Queue Clearance Time (g_s), s						3.4		15.3
Green Extension Time (g_e), s		0.0		0.0		0.0		0.2
Phase Call Probability						1.00		1.00
Max Out Probability						0.60		1.00

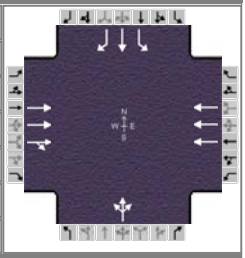
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12		6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		868	431		1273			28		279	138	199
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1700	1686		1544			1525		1619	1700	1441
Queue Service Time (g_s), s		14.4	14.4		15.9			1.4		13.3	5.7	10.3
Cycle Queue Clearance Time (g_c), s		14.4	14.4		15.9			1.4		13.3	5.7	10.3
Capacity *(c)*, veh/h		1615	801		2200			152		324	340	288
Volume-to-Capacity Ratio *(X)*		0.538	0.538		0.579			0.185		0.863	0.406	0.690
Available Capacity (c_a), veh/h		1615	801		2200			152		324	340	288
Back of Queue *(Q)*, veh/ln (50th percentile)		5.3	5.5		5.2			0.5		6.8	2.3	3.9
Overflow Queue (Q_3), veh/ln		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00		0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		14.8	14.8		15.2			33.0		30.9	27.9	29.7
Incremental Delay (d_2), s/veh		1.3	2.6		1.1			0.6		20.6	0.8	6.8
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		16.1	17.4		16.3			33.6		51.5	28.6	36.5
Level of Service (LOS)		B	B		B			C		D	C	D
Approach Delay, s/veh / LOS	16.5	B		16.3	B		33.6	C		41.5	D	
Intersection Delay, s/veh / LOS	21.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.2	A	1.2	A	0.5	A	1.5	A

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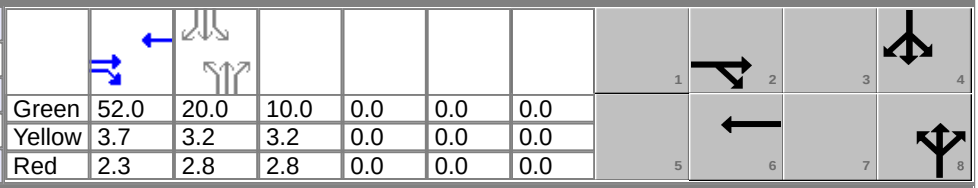
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	8/1/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.92
Intersection	10th Ave. S / 25th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_25thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1725	30		1570		47	0	15	206	134	217

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	52.0	20.0	10.0	0.0	0.0	0.0						
Yellow	3.7	3.2	3.2	0.0	0.0	0.0						
Red	2.3	2.8	2.8	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		12.0		9.0
Phase Duration, s		58.0		58.0		16.0		26.0
Change Period, *(Y+Rc)*, s		6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s		0.0		0.0		4.2		4.2
Queue Clearance Time (g_s), s						6.0		17.7
Green Extension Time (g_e), s		0.0		0.0		0.0		0.6
Phase Call Probability						1.00		1.00
Max Out Probability						1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12		6		3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h		1275	632		1707			67		224	146	236
Adjusted Saturation Flow Rate *(s)*, veh/h/ln		1700	1684		1544			1572		1619	1700	1441
Queue Service Time (g_s), s		28.8	28.9		28.0			4.0		12.8	7.5	15.7
Cycle Queue Clearance Time (g_c), s		28.8	28.9		28.0			4.0		12.8	7.5	15.7
Capacity *(c)*, veh/h		1768	876		2408			157		324	340	288
Volume-to-Capacity Ratio *(X)*		0.721	0.722		0.709			0.429		0.691	0.428	0.819
Available Capacity (c_a), veh/h		1768	876		2408			157		324	340	288
Back of Queue *(Q)*, veh/ln (50th percentile)		11.0	11.6		9.6			1.6		5.5	3.1	6.7
Overflow Queue (Q_3), veh/ln		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)		0.00	0.00		0.00			0.00		0.00	0.00	0.00
Uniform Delay (d_1), s/veh		18.4	18.4		18.2			42.3		37.1	35.0	38.3
Incremental Delay (d_2), s/veh		2.6	5.1		1.8			1.8		6.2	0.9	16.7
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0			0.0		0.0	0.0	0.0
Control Delay *(d)*, s/veh		21.0	23.6		20.0			44.2		43.3	35.9	55.0
Level of Service (LOS)		C	C		C			D		D	D	E
Approach Delay, s/veh / LOS	21.9	C		20.0	C		44.2	D		46.1	D	
Intersection Delay, s/veh / LOS	24.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.4	B	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.5	A	1.4	A	0.6	A	1.5	A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Trisha Bodlovic*	Intersection	*11th Ave. S / 26th St. S*
Agency/Co.	*Robert Peccia & Associates*	Jurisdiction	*Great Falls*
Date Performed	*6/27/2013*	Analysis Year	*2013 - Existing*
Analysis Time Period	*AM Peak Hour*		

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*1*	*191*	*38*	*123*	*291*	*0*
Peak-Hour Factor, PHF	*0.25*	*0.87*	*0.68*	*0.79*	*0.69*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*4*	*219*	*55*	*155*	*421*	*0*
Percent Heavy Vehicles	*0*	--	--		--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*1*	*1*
Configuration	*LT*		*TR*	*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*2*	*1*	*0*	*27*	*1*	*88*
Peak-Hour Factor, PHF	*0.25*	*0.25*	*0.25*	*0.68*	*0.25*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*8*	*4*	*0*	*39*	*4*	*100*
Percent Heavy Vehicles	*17*	*25*	*0*	*1*	*9*	*1*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*4*	*155*	*43*		*100*		*12*	
C (m) (veh/h)	*1149*	*1286*	*175*		*914*		*174*	
v/c	*0.00*	*0.12*	*0.25*		*0.11*		*0.07*	
95% queue length	*0.01*	*0.41*	*0.93*		*0.37*		*0.22*	
Control Delay (s/veh)	*8.1*	*8.2*	*32.1*		*9.4*		*27.2*	
LOS	*A*	*A*	*D*		*A*		*D*	
Approach Delay (s/veh)	--	--	*16.3*			*27.2*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*11th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*2*	*393*	*49*	*120*	*161*	*4*
Peak-Hour Factor, PHF	*0.50*	*0.86*	*0.53*	*0.94*	*0.92*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*4*	*456*	*92*	*127*	*174*	*8*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*1*	*1*
Configuration	*LT*		*TR*	*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*0*	*1*	*1*	*42*	*2*	*294*
Peak-Hour Factor, PHF	*0.25*	*0.25*	*0.25*	*0.75*	*0.50*	*0.81*
Hourly Flow Rate, HFR (veh/h)	*0*	*4*	*4*	*56*	*4*	*362*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*4*	*127*	*60*		*362*		*8*	
C (m) (veh/h)	*1405*	*1032*	*193*		*770*		*345*	
v/c	*0.00*	*0.12*	*0.31*		*0.47*		*0.02*	
95% queue length	*0.01*	*0.42*	*1.26*		*2.54*		*0.07*	
Control Delay (s/veh)	*7.6*	*9.0*	*31.9*		*13.8*		*15.7*	
LOS	*A*	*A*	*D*		*B*		*C*	
Approach Delay (s/veh)	--	--	*16.3*			*15.7*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Trisha Bodlovic*	Intersection	*13th Ave. S / 26th St. S*
Agency/Co.	*Robert Peccia & Associates*	Jurisdiction	*Great Falls*
Date Performed		Analysis Year	*2013 - Existing*
Analysis Time Period	*AM Peak Hour*		

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*12*	*190*	*5*	*29*	*287*	*26*
Peak-Hour Factor, PHF	*0.60*	*0.74*	*0.63*	*0.66*	*0.84*	*0.43*
Hourly Flow Rate, HFR (veh/h)	*19*	*256*	*7*	*43*	*341*	*60*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*2*	*10*	*1*	*1*	*4*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.36*	*0.25*	*0.25*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*7*	*8*	*27*	*4*	*4*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*19*	*43*		*16*			*42*	
C (m) (veh/h)	*1159*	*1309*		*486*			*531*	
v/c	*0.02*	*0.03*		*0.03*			*0.08*	
95% queue length	*0.05*	*0.10*		*0.10*			*0.26*	
Control Delay (s/veh)	*8.2*	*7.8*		*12.7*			*12.4*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*12.7*			*12.4*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*13th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *13th Avenue South* North/South Street: *26th Street South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*8*	*401*	*6*	*33*	*169*	*22*
Peak-Hour Factor, PHF	*0.50*	*0.78*	*0.75*	*0.55*	*0.94*	*0.69*
Hourly Flow Rate, HFR (veh/h)	*16*	*514*	*8*	*59*	*179*	*31*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*26*	*1*	*10*	*1*	*1*	*6*
Peak-Hour Factor, PHF	*0.72*	*0.25*	*0.83*	*0.25*	*0.25*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*36*	*4*	*12*	*4*	*4*	*12*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*16*	*59*		*20*			*52*	
C (m) (veh/h)	*1359*	*1055*		*433*			*371*	
v/c	*0.01*	*0.06*		*0.05*			*0.14*	
95% queue length	*0.04*	*0.18*		*0.14*			*0.48*	
Control Delay (s/veh)	*7.7*	*8.6*		*13.7*			*16.3*	
LOS	*A*	*A*		*B*			*C*	
Approach Delay (s/veh)	--	--	*13.7*			*16.3*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*15th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *15th Avenue South* North/South Street: *26th Street South*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*155*	*18*	*71*	*196*	*19*
Peak-Hour Factor, PHF	*0.42*	*0.84*	*0.50*	*0.71*	*0.78*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*23*	*184*	*36*	*100*	*251*	*27*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*23*	*29*	*4*	*23*	*30*
Peak-Hour Factor, PHF	*0.75*	*0.52*	*0.66*	*0.50*	*0.48*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*8*	*44*	*43*	*8*	*47*	*40*
Percent Heavy Vehicles	*0*	*0*	*3*	*0*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*23*	*100*		*95*			*95*	
C (m) (veh/h)	*1268*	*1357*		*432*			*431*	
v/c	*0.02*	*0.07*		*0.22*			*0.22*	
95% queue length	*0.06*	*0.24*		*0.83*			*0.83*	
Control Delay (s/veh)	*7.9*	*7.9*		*15.7*			*15.7*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*15.7*			*15.7*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/1/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*15th Ave. S / 26th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *15th Avenue South* | North/South Street: *26th Street South*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*24*	*277*	*17*	*23*	*123*	*12*
Peak-Hour Factor, PHF	*0.50*	*0.82*	*0.60*	*0.64*	*0.83*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*48*	*337*	*28*	*35*	*148*	*16*
Percent Heavy Vehicles	*0*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*22*	*24*	*29*	*29*	*35*	*98*
Peak-Hour Factor, PHF	*0.79*	*0.50*	*0.81*	*0.73*	*0.73*	*0.70*
Hourly Flow Rate, HFR (veh/h)	*27*	*48*	*35*	*39*	*47*	*140*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*		*LTR*			*LTR*	
v (veh/h)	*48*	*35*		*226*			*110*	
C (m) (veh/h)	*1417*	*1170*		*531*			*421*	
v/c	*0.03*	*0.03*		*0.43*			*0.26*	
95% queue length	*0.11*	*0.09*		*2.11*			*1.03*	
Control Delay (s/veh)	*7.6*	*8.2*		*16.7*			*16.5*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*16.7*			*16.5*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*10th Ave. S / 29th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *10th Avenue South* | North/South Street: *29th Street South*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*11*	*637*	*140*	*97*	*954*	*6*
Peak-Hour Factor, PHF	*0.55*	*0.85*	*0.61*	*0.71*	*0.79*	*0.50*
Hourly Flow Rate, HFR (veh/h)	*19*	*749*	*229*	*136*	*1207*	*12*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*1*	*24*	*3*	*3*	*17*
Peak-Hour Factor, PHF	*0.63*	*0.25*	*0.67*	*0.75*	*0.38*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*7*	*4*	*35*	*4*	*7*	*23*
Percent Heavy Vehicles	*0*	*0*	*1*	*0*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*19*	*136*		*46*			*34*	
C (m) (veh/h)	*567*	*701*		*106*			*70*	
v/c	*0.03*	*0.19*		*0.43*			*0.49*	
95% queue length	*0.10*	*0.71*		*1.85*			*1.97*	
Control Delay (s/veh)	*11.6*	*11.4*		*62.8*			*97.7*	
LOS	*B*	*B*		*F*			*F*	
Approach Delay (s/veh)	--	--	*62.8*			*97.7*		
Approach LOS	--	--	*F*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/27/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*10th Ave. S / 29th St. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *10th Avenue South* | North/South Street: *29th Street South*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*54*	*1307*	*39*	*25*	*1183*	*15*
Peak-Hour Factor, PHF	*0.68*	*0.98*	*0.75*	*0.63*	*0.95*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*79*	*1333*	*52*	*39*	*1245*	*20*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*77*	*0*	*0*	*20*
Peak-Hour Factor, PHF	*0.42*	*0.25*	*0.88*	*0.25*	*0.25*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*11*	*0*	*87*	*0*	*0*	*28*
Percent Heavy Vehicles	*0*	*0*	*1*	*0*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*79*	*39*		*98*			*28*	
C (m) (veh/h)	*545*	*490*		*131*			*476*	
v/c	*0.14*	*0.08*		*0.75*			*0.06*	
95% queue length	*0.50*	*0.26*		*4.34*			*0.19*	
Control Delay (s/veh)	*12.7*	*13.0*		*87.4*			*13.0*	
LOS	*B*	*B*		*F*			*B*	
Approach Delay (s/veh)	--	--	*87.4*			*13.0*		
Approach LOS	--	--	*F*			*B*		

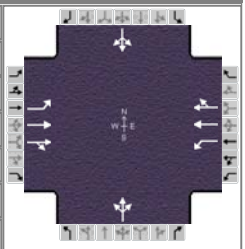
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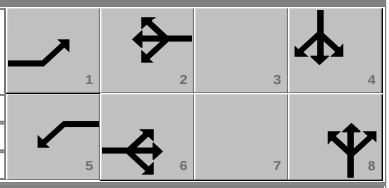
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	7/30/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.83
Intersection	10th Ave. S / 32nd St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10_10thAveS_32ndStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	664	37	26	916	3	145	22	19	32	39	85

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	1.0	52.0	20.0	0.0	0.0
Yellow	3.6	0.0	3.6	3.0	0.0	0.0
Red	1.4	0.0	2.4	3.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	4.0	1.1	4.0		8.0		8.0
Phase Duration, s	11.0	59.0	10.0	58.0		26.0		26.0
Change Period, *(Y+Rc)*, s	5.0	6.0	5.0	6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	2.6	0.0	2.6	0.0		2.8		2.8
Queue Clearance Time (g_s), s	2.5		2.7			22.0		12.7
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.4
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.14		1.00			1.00		0.03

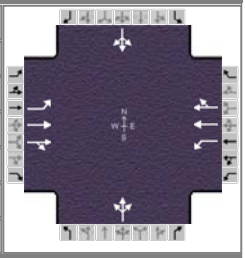
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	24	426	418	31	554	553		224			188	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1650	1619	1619	1650	1649		921			1523	
Queue Service Time (g_s), s	0.5	14.6	14.6	0.7	21.7	21.7		9.3			0.0	
Cycle Queue Clearance Time (g_c), s	0.5	14.6	14.6	0.7	21.7	21.7		20.0			10.7	
Capacity *(c)*, veh/h	343	921	903	428	903	902		261			366	
Volume-to-Capacity Ratio *(X)*	0.070	0.463	0.463	0.073	0.613	0.613		0.857			0.513	
Available Capacity (c_a), veh/h	343	921	903	428	903	902		261			366	
Back of Queue *(Q)*, veh/ln (50th percentile)	0.2	5.3	5.3	0.2	8.1	8.1		6.9			3.9	
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	9.8	12.5	12.5	8.8	14.6	14.6		40.5			33.9	
Incremental Delay (d_2), s/veh	0.0	1.7	1.7	0.0	3.1	3.1		22.6			0.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay *(d)*, s/veh	9.8	14.2	14.2	8.8	17.8	17.8		63.1			34.4	
Level of Service (LOS)	A	B	B	A	B	B		E			C	
Approach Delay, s/veh / LOS	14.1	B		17.5	B		63.1	E		34.4	C	
Intersection Delay, s/veh / LOS	21.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.1	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.2	A	1.4	A	0.9	A	0.8	A

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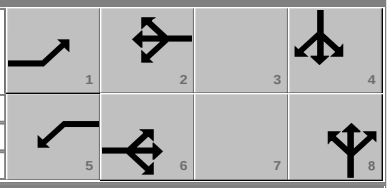
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	7/30/2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.83
Intersection	10th Ave. S / 32nd St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10_10thAveS_32ndStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	91	1361	27	59	1151	10	119	73	74	59	58	75

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	61.0	27.0	0.0	0.0	0.0
Yellow	3.6	3.6	3.0	0.0	0.0	0.0
Red	1.4	2.4	3.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6	5	2		8		4
Case Number	1.1	4.0	1.1	4.0		8.0		8.0
Phase Duration, s	10.0	67.0	10.0	67.0		33.0		33.0
Change Period, *(Y+Rc)*, s	5.0	6.0	5.0	6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	4.1	0.0	4.1	0.0		4.3		4.3
Queue Clearance Time (g_s), s	5.2		4.0			29.0		19.6
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		1.4
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		0.37

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	110	838	835	71	700	699		320			231	
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1683	1670	1619	1650	1645		1074			1290	
Queue Service Time (g_s), s	3.2	48.6	49.0	2.0	36.1	36.1		9.4			0.0	
Cycle Queue Clearance Time (g_c), s	3.2	48.6	49.0	2.0	36.1	36.1		27.0			17.6	
Capacity *(c)*, veh/h	228	933	926	172	915	912		311			359	
Volume-to-Capacity Ratio *(X)*	0.482	0.898	0.901	0.413	0.765	0.766		1.030			0.644	
Available Capacity (c_a), veh/h	228	933	926	172	915	912		311			359	
Back of Queue *(Q)*, veh/ln (50th percentile)	1.2	20.9	21.0	1.1	14.3	14.3		13.6			6.0	
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	17.7	21.7	21.8	23.3	19.0	19.0		44.5			37.6	
Incremental Delay (d_2), s/veh	1.6	13.1	13.6	1.6	6.1	6.1		59.0			3.9	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay *(d)*, s/veh	19.3	34.9	35.4	24.9	25.0	25.1		103.5			41.5	
Level of Service (LOS)	B	C	D	C	C	C		F			D	
Approach Delay, s/veh / LOS	34.2	C		25.0	C		103.5	F		41.5	D	
Intersection Delay, s/veh / LOS	36.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.1	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	2.0	A	1.7	A	1.0	A	0.9	A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*32nd St. S / 11th Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* North/South Street: *32nd Street South*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*16*	*38*	*2*	*2*	*145*	*109*
Peak-Hour Factor, PHF	*0.67*	*0.79*	*0.25*	*0.25*	*0.59*	*0.68*
Hourly Flow Rate, HFR (veh/h)	*23*	*48*	*8*	*8*	*245*	*160*
Percent Heavy Vehicles	*0*	--	--	*50*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*9*	*0*	*5*	*4*	*51*
Peak-Hour Factor, PHF	*0.33*	*0.75*	*0.25*	*0.63*	*0.50*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*12*	*12*	*0*	*7*	*8*	*71*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*23*	*8*		*24*			*86*	
C (m) (veh/h)	*1157*	*1287*		*437*			*660*	
v/c	*0.02*	*0.01*		*0.05*			*0.13*	
95% queue length	*0.06*	*0.02*		*0.17*			*0.45*	
Control Delay (s/veh)	*8.2*	*7.8*		*13.7*			*11.3*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*13.7*			*11.3*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*7/2/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*32nd St. S / 11th Ave. S*
Jurisdiction	*Great Falls*
Analysis Year	*2013 - Existing*

Project Description *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *11th Avenue South* | North/South Street: *32nd Street South*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*74*	*146*	*10*	*2*	*87*	*90*
Peak-Hour Factor, PHF	*0.84*	*0.78*	*0.63*	*0.50*	*0.73*	*0.83*
Hourly Flow Rate, HFR (veh/h)	*88*	*187*	*15*	*4*	*119*	*108*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*12*	*1*	*16*	*12*	*51*
Peak-Hour Factor, PHF	*0.50*	*0.60*	*0.25*	*0.80*	*0.75*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*8*	*19*	*4*	*19*	*16*	*63*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*88*	*4*		*31*			*98*	
C (m) (veh/h)	*1345*	*1378*		*399*			*608*	
v/c	*0.07*	*0.00*		*0.08*			*0.16*	
95% queue length	*0.21*	*0.01*		*0.25*			*0.57*	
Control Delay (s/veh)	*7.9*	*7.6*		*14.8*			*12.1*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*14.8*			*12.1*		
Approach LOS	--	--	*B*			*B*		

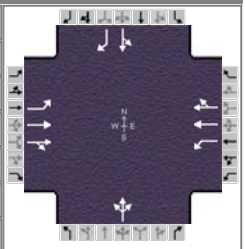
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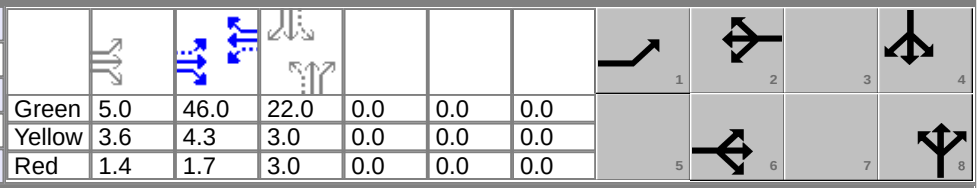
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	AM Peak Hour	PHF	0.85
Intersection	10th Ave. S / 38th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_38thStS_AM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	548	0	3	797	37	1	2	1	95	2	231

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	46.0	22.0	0.0	0.0	0.0
Yellow	3.6	4.3	3.0	0.0	0.0	0.0
Red	1.4	1.7	3.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		8		4
Case Number	1.0	4.0		6.3		8.0		7.0
Phase Duration, s	10.0	62.0		52.0		28.0		28.0
Change Period, *(Y+Rc)*, s	5.0	6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	4.1	0.0		0.0		4.3		4.3
Queue Clearance Time (g_s), s	7.0					15.9		18.6
Green Extension Time (g_e), s	0.0	0.0		0.0		0.8		0.5
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	1.00					0.46		1.00

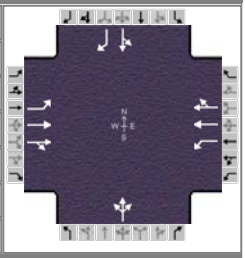
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	188	645	0	4	495	487		5			114	272
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1557	1650	0	798	1635	1609		957			897	1382
Queue Service Time (g_s), s	5.0	8.3	0.0	0.2	19.1	19.1		0.0			2.0	16.6
Cycle Queue Clearance Time (g_c), s	5.0	8.3	0.0	0.2	19.1	19.1		13.9			14.9	16.6
Capacity *(c)*, veh/h	334	2054		488	835	822		284			298	338
Volume-to-Capacity Ratio *(X)*	0.564	0.314	0.000	0.007	0.592	0.592		0.017			0.382	0.805
Available Capacity (c_a), veh/h	334	2054		488	835	822		284			298	338
Back of Queue *(Q)*, veh/ln (50th percentile)	1.7	2.6		0.0	7.2	7.1		0.1			2.3	6.6
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00
Uniform Delay (d_1), s/veh	12.6	8.0		10.8	15.4	15.4		26.1			32.4	32.0
Incremental Delay (d_2), s/veh	2.2	0.4	0.0	0.0	3.1	3.1		0.0			0.8	13.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Control Delay *(d)*, s/veh	14.8	8.4		10.8	18.5	18.5		26.2			33.2	45.2
Level of Service (LOS)	B	A		B	B	B		C			C	D
Approach Delay, s/veh / LOS	9.8	A		18.5	B		26.2	C		41.7	D	
Intersection Delay, s/veh / LOS	19.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.3	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.2	A	1.3	A	0.5	A	1.1	A

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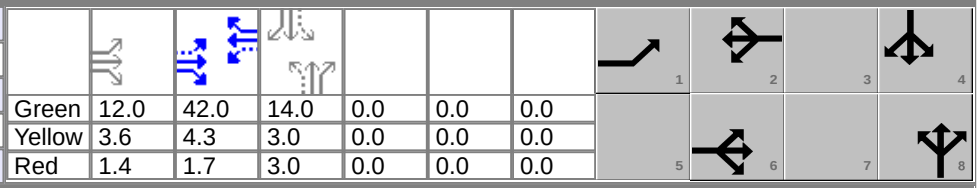
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Robert Peccia & Associates			Duration, h	0.25
Analyst	Trisha Bodlovic	Analysis Date	Aug 8, 2013	Area Type	Other
Jurisdiction	Great Falls	Time Period	PM Peak Hour	PHF	0.91
Intersection	10th Ave. S / 38th St. S	Analysis Year	2035 - Future	Analysis Period	1> 7:00
File Name	10thAveS_38thStS_PM.xus				
Project Description	Great Falls Area LRTP - 2014				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	295	990	1	5	1103	95	4	2	3	132	5	212

Signal Information			
Cycle, s	85.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.0	42.0	14.0	0.0	0.0	0.0
Yellow	3.6	4.3	3.0	0.0	0.0	0.0
Red	1.4	1.7	3.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2		8		4
Case Number	1.0	4.0		6.3		8.0		7.0
Phase Duration, s	17.0	65.0		48.0		20.0		20.0
Change Period, *(Y+Rc)*, s	5.0	6.0		6.0		6.0		6.0
Max Allow Headway *(MAH)*, s	3.1	0.0		0.0		4.3		4.3
Queue Clearance Time *(g_s)*, s	10.6					16.0		16.0
Green Extension Time *(g_e)*, s	0.1	0.0		0.0		0.0		0.0
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	1.00					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	3	8	18	7	4	14
Adjusted Flow Rate *(v)*, veh/h	324	545	544	5	667	650		10			151	233
Adjusted Saturation Flow Rate *(s)*, veh/h/ln	1619	1667	1666	526	1650	1604		282			786	1426
Queue Service Time *(g_s)*, s	8.6	12.6	12.6	0.5	29.1	29.3		0.0			0.0	13.9
Cycle Queue Clearance Time *(g_c)*, s	8.6	12.6	12.6	0.5	29.1	29.3		14.0			14.0	13.9
Capacity *(c)*, veh/h	377	1157	1156	345	816	792		108			213	235
Volume-to-Capacity Ratio *(X)*	0.861	0.471	0.471	0.016	0.817	0.820		0.092			0.708	0.992
Available Capacity *(c_a)*, veh/h	377	1157	1156	345	816	792		108			213	235
Back of Queue *(Q)*, veh/ln (50th percentile)	4.8	3.8	3.8	0.1	11.9	11.7		0.2			3.7	8.3
Overflow Queue *(Q_3)*, veh/ln	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Queue Storage Ratio *(RQ)* (50th percentile)	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00
Uniform Delay *(d_1)*, s/veh	18.6	5.9	5.9	11.0	18.2	18.3		30.6			36.5	35.4
Incremental Delay *(d_2)*, s/veh	17.2	1.4	1.4	0.1	8.9	9.3		0.4			10.3	56.2
Initial Queue Delay *(d_3)*, s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Control Delay *(d)*, s/veh	35.8	7.3	7.3	11.1	27.2	27.6		31.0			46.8	91.7
Level of Service (LOS)	D	A	A	B	C	C		C			D	F
Approach Delay, s/veh / LOS	13.8	B		27.3	C		31.0	C		74.1	E	
Intersection Delay, s/veh / LOS	27.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.0	B	2.3	B	2.8	C	2.8	C
Bicycle LOS Score / LOS	1.7	A	1.6	A	0.5	A	1.1	A

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*38th St. / Central Ave.*
Jurisdiction	*Great Falls*
Analysis Year	

Project ID *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Central Avenue* North/South Street: *38th Street*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*8*	*147*	*46*	*39*	*101*	*69*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*48*	*193*	*47*	*45*	*203*	*21*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*LTR*		*LTR*		*LTR*	
PHF	*0.73*		*0.68*		*0.89*		*0.81*	
Flow Rate (veh/h)	*274*		*306*		*321*		*330*	
% Heavy Vehicles	*0*		*0*		*1*		*0*	
No. Lanes	*1*		*1*		*1*		*1*	
Geometry Group	*1*		*1*		*1*		*1*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.0*		*0.2*		*0.2*		*0.2*	
Prop. Right-Turns	*0.2*		*0.3*		*0.2*		*0.1*	
Prop. Heavy Vehicle	*0.0*		*0.0*		*0.0*		*0.0*	
hLT-adj	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
hRT-adj	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*-0.1*		*-0.2*		*-0.0*		*-0.0*	

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*		*3.20*		*3.20*	
x, initial	*0.24*		*0.27*		*0.29*		*0.29*	
hd, final value (s)	*6.90*		*6.78*		*6.79*		*6.80*	
x, final value	*0.53*		*0.58*		*0.61*		*0.62*	
Move-up time, m (s)	*2.0*		*2.0*		*2.0*		*2.0*	
Service Time, t_s (s)	*4.9*		*4.8*		*4.8*		*4.8*	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*460*		*478*		*484*		*487*	
Delay (s/veh)	*17.29*		*18.61*		*19.68*		*20.40*	
LOS	*C*		*C*		*C*		*C*	
Approach: Delay (s/veh)	*17.29*		*18.61*		*19.68*		*20.40*	
LOS	*C*		*C*		*C*		*C*	
Intersection Delay (s/veh)	*19.08*							
Intersection LOS	*C*							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Trisha Bodlovic*
Agency/Co.	*Robert Peccia & Associates*
Date Performed	*6/17/2013*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*38th St. / Central Ave.*
Jurisdiction	*Great Falls*
Analysis Year	

Project ID *Great Falls Area Long Range Transportation Plan - 2014*

East/West Street: *Central Avenue* North/South Street: *38th Street*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*18*	*77*	*7*	*28*	*50*	*27*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*39*	*300*	*22*	*21*	*319*	*30*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*LTR*		*LTR*		*LTR*	
PHF	*0.84*		*0.81*		*0.84*		*0.88*	
Flow Rate (veh/h)	*120*		*128*		*429*		*419*	
% Heavy Vehicles	*1*		*0*		*0*		*0*	
No. Lanes	*1*		*1*		*1*		*1*	
Geometry Group	*1*		*1*		*1*		*1*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.2*		*0.3*		*0.1*		*0.1*	
Prop. Right-Turns	*0.1*		*0.3*		*0.1*		*0.1*	
Prop. Heavy Vehicle	*0.0*		*0.0*		*0.0*		*0.0*	
hLT-adj	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
hRT-adj	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*	*-0.6*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.0*		*-0.1*		*-0.0*		*-0.0*	

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*		*3.20*		*3.20*	
x, initial	*0.11*		*0.11*		*0.38*		*0.37*	
hd, final value (s)	*6.51*		*6.37*		*5.38*		*5.38*	
x, final value	*0.22*		*0.23*		*0.64*		*0.63*	
Move-up time, m (s)	*2.0*		*2.0*		*2.0*		*2.0*	
Service Time, t_s (s)	*4.5*		*4.4*		*3.4*		*3.4*	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*370*		*378*		*647*		*646*	
Delay (s/veh)	*11.30*		*11.23*		*17.50*		*16.94*	
LOS	*B*		*B*		*C*		*C*	
Approach: Delay (s/veh)	*11.30*		*11.23*		*17.50*		*16.94*	
LOS	*B*		*B*		*C*		*C*	
Intersection Delay (s/veh)	*15.87*							
Intersection LOS	*C*							

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APPENDIX F:
Facility Recommendations



FACILITY RECOMMENDATIONS

April 12, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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FACILITY RECOMMENDEDATIONS

1.0 INTRODUCTION

This memorandum presents a variety of recommended improvements for the Great Falls area transportation system aimed at addressing current and anticipated future needs. Recommendations contained in the 2014 LRTP were reviewed and updated to reflect their current status and the changing needs and desires of the Great Falls community. A combination of public outreach, project solicitation from partnering agencies, travel demand modeling, traffic engineering analysis, and policy choices to support the identified goals and objectives were utilized during development of the 2014 LRTP to guide the identification of recommendations. Public and stakeholder input was solicited during development of the 2018 LRTP to update the recommendations. In most cases, the recommended projects are needed to bring roadways up to current standards, address existing operational concerns, or meet anticipated traffic demands for the year 2038.

As a Metropolitan Planning Organization (MPO), Great Falls is required to develop an LRTP that has a prioritized, fiscally constrained menu of projects. Projects are categorized into categories based on status and availability of funding. Recommendations categorized as “committed” are those with dedicated funding as identified in either the Transportation Improvement Program (TIP), through local funds, transit funds, private funds, or other sources and are planned to be completed in a five-year time frame (2018-2022). “Annual programs” are programs that receive an annual allocation of funding but do not have specific projects assigned to them, these programs occur yearly through the 20-year planning horizon (2018-2038). Projects categorized as “recommended”, are recommended to be completed within the planning horizon (year 2038), but may need further analysis or identification of funding before being fully committed to. “Illustrative” projects are currently unfunded recommendations that are supported by a sponsoring agency, but are not prioritized for implementation over the planning horizon.

Also included are non-motorized recommendations which address needs for accommodating pedestrians and bicyclists in the Great Falls Area, and to provide for mode choice for transportation users. Although estimated costs are given for the non-motorized recommendations, neither a funding source or a year of expenditure are assigned to the projects. It is expected that the non-motorized projects be completed in conjunction with other facility recommendations or as funding becomes available.

2.0 PAST PLANNING RECOMMENDATIONS

This section includes a summary of recommendations found in past planning documents within the LRTP study area. Each recommendation provides a description and status of the project (completed, partially completed, or not completed) as well as if the recommendation has been carried forward as part of the current LRTP recommendations. Some of the recommendations from past planning efforts have not been completed and were not included in this report for a variety of reasons. These reasons may include lack of feasibility, changed traffic conditions, or the project may be considered outside the scope of this LRTP.

2.1. River Drive Corridor Study

Completion of a corridor study for River Drive between 15th Street North and 38th Street North was recommended in the 2014 LRTP as MSN-1. Traffic analyses found that the existing two-lane facility would be inadequate to handle future traffic volumes and an expansion of the existing facility would be needed by the year 2035. A corridor study was recommended due to a high level of public interest in the

corridor and its close proximity to the Missouri River and River's Edge Trail. An assessment of the viability of non-motorized amenities was also recommended as previous public feedback identified this route as an important gap in the visionary bicycle network for the community.

The *River Drive Corridor Study*[1] was completed in September of 2016. Eight spot improvements and two combined improvement options for the study corridor were identified. The two combined options recommended the entire be reconstructed in two phases. The improvement options were each given an estimated implementation timeframe; short-term (0-5 years), mid-term (5-10 years), and long-term (10-20 years). None of the recommended improvement options have been completed and the two combined improvement options have been carried forward in the recommendations for the 2018 LRTP. **Table 1** presents the recommendations from the 2016 corridor study and their status for the current LRTP.

Table 1: Recommendations from River Drive Corridor Study

ID	Improvement Option/Location	Past Recommendation	Status for 2018 LRTP
SPOT IMPROVEMENT OPTIONS			
1.	15th Street North Intersection	Mid-term. Extend the westbound right-turn lane to accommodate vehicle queues.	**NOT COMPLETE** Included with Combined Option 1
2.	19th Street North Intersection	Short-term. Evaluate and install enhanced non-motorized crossing treatments.	**NOT COMPLETE** Included with Combined Option 1
3.	Big Stack Mobile Home Court Approach	Mid-term. Reconstruct or relocated the existing approach to River Drive.	**NOT COMPLETE** Included with Combined Option 1
4.	Business District Access	Mid-term. Reconstruct roadway to provide for a center left-turn lane, bike lanes, and sidewalk on the south side.	**NOT COMPLETE** Included with Combined Option 1
5.	25th Street North Intersection	Mid-term. Install additional traffic control such as a traffic signal or roundabout in coordination with corridor improvement options.	**NOT COMPLETE** Included with Combined Option 1
6.	Eagle Falls Golf Club Access	Mid-term. Construct a new access along River Drive North near Eagle Falls Golf Club.	**NOT COMPLETE** Included with Combined Option 2
7.	Rail Road Crossing Review	Short-term. Perform a diagnostic review of the railroad crossing.	**NOT COMPLETE**
8.	River Drive North Reconstruction	Mid- to Long-term. Reconstruct to include one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations.	**NOT COMPLETE** Included with Combined Options 1 and 2
COMBINED IMPROVEMENT OPTIONS			
1.	Segment 1 – 15th Street North to 25th Street North	Mid- to Long-term. Include recommendations from options 1, 2, 3, 4, 5, and 8.	**NOT COMPLETE** Modified and Included as **R-1**
2.	Segment 2 – 25th Street North to 38th Street North	Mid- to Long-term. Include recommendations from options 6 and 8.	**NOT COMPLETE** Modified and Included as **I-38**

[1] River Drive Corridor Study, Montana Department of Transportation, September 19, 2016, http://www.mdt.mt.gov/pubinvolve/riverdrive/docs/RiverDrive-Final-Report.pdf

2.2. I-15 Gore Hill to Emerson Junction Corridor Planning Study

The 2014 LRTP identified I-15 through Great Falls as a prime candidate for a corridor study. The recommendation, MSN-4, noted that both the Emerson Junction and Gore Hill interchanges were in need of improvements. Needs for added lanes and operational improvements on I-15 and I-315 were also identified. The intent of the Corridor Study was to assist in identifying potential locations, priorities, costs and scope of improvements.

As recommended, the *I-15 Gore Hill to Emerson Junction Corridor Study*[2] was completed in May of 2015 and included I-15 between Gore Hill and Emerson Junction interchanges, as well as I-315 and 10th Avenue South to the west of the Missouri River. A total of 14 individual recommended improvement options were identified in the final report. The improvement options were given a recommended timeframe for implementation; short-term (0-5 years), mid-term (5-10 years), and long-term (10-20 years). Of the 14 projects, none have been completed and 5 have been carried forward in the recommendations for the 2018 LRTP. **Table 2** presents the recommendations from the 2015 corridor study and their status for the current LRTP.

Table 2: Recommendations from I-15 Corridor Planning Study

ID	Improvement Option/Location	Past Recommendation	Status for 2018 LRTP
		INTERSTATE 15	
1.0	Southbound Auxiliary Lane (RP 278.1 to 278.5)	Mid-term. Construct auxiliary lane between Gore Hill and 10th Ave S interchanges in the southbound direction.	**IN PROGRESS** Modified and Included as **R-11**
2(a)	Roadway Illumination (RP 282.3 to 283.0)	Mid-term. Install additional illumination along the Interstate.	**NOT COMPLETE**
2(b)	Reconstruct Roadway (RP 282.3 to 283.0)	Long-term. Reconstruct roadway and bridge structures to meet current design standards.	**NOT COMPLETE**
		INTERSTATE 315	
3.0	Pavement Rehabilitation (RP 0.0 to 1.4)	Mid-term. Resurface both directions of I-315.	**NOT COMPLETE** Modified and Included as **C-16**
4.0	Bridge Deck Treatment	Mid-term. Rehabilitate bridge decks on I-15 Overpass (RP 0.01), 14th St SW Overpass (EB), and 14th St SW Overpass (WB).	**NOT COMPLETE** Modified and Included as **C-2**
5.0	Diagrammatic Guide Signing (10th Ave S to 14th St SW)	Short-term. Install overhead diagrammatic guide signage for eastbound traffic.	**NOT COMPLETE**
6.0	Westbound Auxiliary Lane (14th St SW to 10th Ave S)	Mid-term. Reconstruct I-315 westbound and the I-15 on-ramp to provide an auxiliary lane.	**NOT COMPLETE**
7.0	Westbound Auxiliary Lane (Fox Farm Rd to 14th St SW)	Mid-term. Reconstruct I-315 westbound and the Fox Farm Road intersection to provide an auxiliary travel lane.	**NOT COMPLETE**
		INTERCHANGES	
8.0	Lengthen Southbound Off-ramp (10th Ave S Interchange)	Mid-term. Lengthen southbound off-ramp.	**NOT COMPLETE**
9.0	Modify Lane Merge (Central Ave West of Interchange)	Short-term. Modify signing and striping.	**NOT COMPLETE**
10.0	Feasibility Analysis (Emerson Junction)	Mid-term. Secure a local project sponsor to fund an operational analysis/feasibility study of the Emerson Junction Interchange.	**NOT COMPLETE** Modified and Included as **R-10**

[2] I-15 Gore Hill to Emerson Junction Corridor Planning Study, Montana Department of Transportation, July 21, 2015, http://www.mdt.mt.gov/pubinvolve/i15/docs/I-15_Final.pdf

ID	Improvement Option/Location	Past Recommendation	Status for 2018 LRTP
		INTERSECTIONS	
11.0	Intersection Improvements (Gore Hill Interchange)	Mid-term. Install additional traffic control such as roundabouts or traffic signals.	**IN PROGRESS** Modified and Included as **R-11**
12.0	Intersection Improvements (Central Ave Interchange)	Long-term. Install traffic control such as roundabouts or traffic signals.	**NOT COMPLETE**
13.0	Intersection Improvements (Fox Farm Intersection)	Mid-term. Install dual eastbound left-turn lanes.	**NOT COMPLETE** Modified and Included as **R-2**

3.0 COMPLETED PROJECTS (2014 LRTP)

Since completion of the 2014 LRTP, the City of Great Falls, Cascade County, and MDT have completed various projects in the LRTP study area. Some of the projects were already committed at the time of the 2014 LRTP and have since been completed. Others were recommended in the plan and have progressed towards project completion in the past four years. The projects which have been completed or are currently in progress will be removed from the recommendations for the 2018 LRTP. **Table 3** presents the projects which were recommended in the 2014 LRTP and have been either completed or are in progress.

Table 3: Completed Recommendations From 2014 LRTP

Project	Improvement Option/Location	Past Recommendation	Status for 2018 LRTP
		COMMITTED SHORT RANGE PROJECTS	
CSR-1	13th Street South (29th Avenue South to Lower River Road)	Asphalt overlay and chip seal 13th Street South for approximately 2.75 miles. The segment of 13th Street South is in poor condition with varying levels of deterioration.	**COMPLETE**
CSR-2	Flood Road (Delea Drive to Woodland Estates Road)	Asphalt overlay Flood Road between Delea Drive and Dick Road (1.3 miles), and chip seal between Delea Drive and Woodland Estates Road (2.4 miles).	**COMPLETE**
CSR-3	MACI Traffic Flow Improvements - 10th Avenue South Signals (UPN 8036-4)	Signal timing & controller upgrades along 10th Avenue South.	**COMPLETE**
CSR-4	MACI Traffic Flow Improvements – 3rd Street NW Signals (UPN 8036-5)	Signal timing & controller upgrades along 10th Avenue South.	**COMPLETE**
CSR-5	GTFLS Signal Borders (UPN 7981)	Install retroreflective borders on mainline signals on 10th Avenue South.	**COMPLETE**
CSR-6	GTFLS Wrong Way Signage – Phase 1 (UPN 8002)	Install wrong way signage at numerous locations on I-15.	**COMPLETE**
CSR-7	GTFLS Horizontal Curve Signing (UPN 7980)	Install upgraded signing at numerous locations.	**PARTIALLY COMPLETE**
CSR-8	GTFLS Advanced Signal Flasher (UPN 8119)	Install advanced signal flasher.	**COMPLETE**
CSR-9	GTFLS Urban Maintenance Program (UPN 7994)	Perform chip seals, overlays and related maintenance activities on urban routes (year 2014).	**COMPLETE**
		RECOMMENDED SHORT RANGE	
SR-3	10th Avenue South and 32nd Street South	Reconfigure 32nd Street South legs of this intersection to align better along a slight skew. These legs are split phased, and by aligning the two legs (i.e. north and south leg), the phasing of the signal can be put on the same phase.	**COMPLETE**

Project	Improvement Option/Location	Past Recommendation	Status for 2018 LRTP
SR-6	City Pavement Preservation Activities	Mill, overlay, seal and cover, chip seal, and/or striping completed or partially completed on 3 of 17 recommended streets: **1. 8th Ave N – 6th to 38th St N** (6th to 26th Complete) **6. Smelter Ave - Division Rd to 6th St NW** **17. Airport Road**	**PARTIALLY COMPLETE** Modified and Included as **P-11**
COMMITTED MAJOR STREET NETWORK			
C-1	South Central Urban Area Arterial Improvement Project (UPN 4566)	Reconstruct three segments of roadway to two-lane collector street standards, with additional capacity, at the following locations: 24th Avenue South between 13th Street South and 26th Street South; 13th Street South between 21st Avenue South and 27th Avenue South; and 26th Street South between 18th Avenue South and 24th Avenue South.	**COMPLETE**
C-2	North Bootlegger Trail – 2KM North of Great Falls North (UPN 4826)	Reconstruct North Bootlegger Trail from the intersection with US 87 to the urban boundary. Between US 87 and the entrance to the Eagle Crossing subdivision the contemplated project is reconstruction to a three-lane typical section. North of the entrance to the Eagle Crossing subdivision the project will rehabilitate the existing surfacing.	**COMPLETE**
C-4	Emerson Junction – Manchester (UPN 7621)	Major rehabilitation for 3.875 miles	**PARTIALLY COMPLETE**
C-6	District 3 Fencing - Great Falls North & South (UPN 7958)	Install fencing at numerous locations within MDT's Great Falls District.	**COMPLETE**
C-7	GTFLS Horizontal Curve Signing (UPN 7980)	Install upgraded signing at numerous locations.	**PARTIALLY COMPLETE**
C-8	GTFLS Advanced Signal Flasher (UPN 8119)	Install advanced signal flasher.	**PARTIALLY COMPLETE**
RECOMMENDED MAJOR STREET NETWORK			
MSN-1	River Drive North – 15th Street North to 38th Street North	Complete a detailed corridor study and environmental assessment to consider reconstruction scenarios for River Drive North (15th Street North to 38th Street North). Reconstruct pending results of investigation.	**PARTIALLY COMPLETE** (corridor study complete)
MSN-3	Reconstruct 36th Avenue NE (9th Street NE to Bootlegger Trail)	Reconstruct to an urban collector standard.	**COMPLETE**
MSN-4	Interstate 15 Corridor Study	Develop a pre-NEPA/MEPA Corridor Planning Study for the interstate in the Great Falls Urban Limits.	**COMPLETE**
ILLUSTRATIVE MAJOR STREET NETWORK			
25.	Fox Farm Road – Dick Road to Fawn Drive	Reconstruct to minor arterial standard.	**COMPLETE**
COMMITTED NON-MOTORIZED			
N/A	Sun River Trail Connection	Bike/Ped facility adjoining Country Club Blvd (from Warden Bridge to Bike/Ped Facility at 6th St SW)	**COMPLETE**
RECOMMENDED NON-MOTORIZED			
N/A	Overlook Drive Shared Use Path (River's Edge Trail to 10th Ave S)	Construct shared use path adjacent to roadway.	**COMPLETE**
N/A	25th St N (9th Ave N to Pasta Place)	Provide a pedestrian bridge over the railroad tracks and sidewalks to provide a walking connection to the stadium.	**COMPLETE**
N/A	Charles Russell Park Trail (29th St S to 33rd St S)	Part of 2013 CTEP process.	**COMPLETE**

4.0 FACILITY IMPROVEMENTS

There are four categories of street improvement projects; committed, annual program, recommended, and illustrative. These categories are consistent with past long range transportation planning efforts completed in the Great Falls community. The categories are defined as follows:

- **Committed**: Committed projects are those with dedicated funding via the TIP, private sources (new development), transit formula funds, local funds, and/or projects with dedicated funding via a completed environmental document. These projects are generally expected to be completed within a five-year time frame (2018-2022).
- **Annual Program:** Programs that receive an annual allocation of funding but do not have specific projects assigned to them, these programs will occur yearly through the 20-year planning horizon.
- **Recommended for Funding**: Projects recommended to be completed through the planning horizon (year 2038), but that may need further analysis before being committed to implementation via inclusion in the TIP.
- **Illustrative (Unfunded)**: Projects or project concepts supported by a sponsoring agency, but not prioritized for implementation or federal funding between 2018 and 2038.

All facility improvement projects are shown in **Figures 1 and 2** at the end of this section.

4.1. Committed Projects

The definition of a committed project is one that has been approved by the PCC and has committed funding available. Projects known to be completed within the next five years (2018 to 2022) are included in this section. Note that known pavement preservation activities are included in this list, even though they are typically addressed through a general "Pavement Preservation" category in the Transportation Improvement Program (TIP), and are typically not described as specific projects. Future projects will likely be included similarly – either as specific projects or as part of the overall "Pavement Preservation Category", as well as covered under "Operation and Maintenance" categories and funding types (**see Section 4.2**).

C-1. Fox Farm Road – East Fiesta to Dick Road (UPN 8193)

Reconstruct to rural minor arterial standard.

- **Estimated Cost: $**3,546,459
- **Funding Source:** STPU

C-2. Bridge Preservation – Great Falls 2014 (UPN 8085)

Overlay bridge decks over the railroad on I-315 between Fox Farm and 10th Ave S.

- **Estimated Cost: $**1,042,745
- **Funding Source:** NHPB

C-3. 14th St SW Signals - GF (UPN 9572)

Retime signals at three locations (16th Ave SW, 14th St SW & Ramp, and Market Place Dr).

- **Estimated Cost: $**32,000
- **Funding Source:** MACI – Discretionary

C-4. NW Bypass Signals – Great Falls (UPN 9573)
Retime signals at two locations (6th St NW and 9th St NW).

- **Estimated Cost:** $25,600
- **Funding Source:** MACI – Discretionary

C-5. Transit Operating Expenses
General transit operating expenses.

- **Estimated Cost:** $39,000
- **Funding Source:** FTA Section 5311

C-6. Transit Capital Purchase
Acquire vehicles and related equipment.

- **Estimated Cost:** $884,000
- **Funding Source:** MACI – Guaranteed

C-7. Great Falls - North (UPN 7625)
Reconstruct and widen US-87, with passing and turn lanes, for approximately 6.67 miles. The project begins approximately 500 feet south of the malting plant approach road, and travels north past the landfill.

- **Estimated Cost:** $4,400,000
- **Funding Source:** NH

C-8. Great Falls South – Urban (Lower River Rd, 55th Ave S and 13th St S) (UPN 9511)
City pavement preservation activities including mill, overlay, seal and cover, chip seal, and/or striping.

- **Estimated Cost:** $1,647,829
- **Funding Source:** UPP

C-9. 3rd St NW – Great Falls (UPN 9053)
New signal upgrades with flashing yellow left turns and ADA ramps where needed.

- **Estimated Cost:** $809,400
- **Funding Source:** MACI – Discretionary

C-10. SF 169 Cascade Cnty SFTY Imprv (UPN 9426)
Countywide safety improvements to address road departure crashes (Lower River Road and 13th St S).

- **Estimated Cost:** $84,000
- **Funding Source:** HSIP

C-11. Park Dr/4th Ave N Ped Xing – GTF Bike/Ped (UPN 9148)
Bike and pedestrian crossing.

- **Estimated Cost:** $265,301
- **Funding Source:** TA

C-12. 2nd Ave N Signals - GF (UPN 9530)
Signal upgrades at four locations, (3rd St, 4th St, 5th St, and 6th St).

- **Estimated Cost:** $23,000
- **Funding Source:** MACI – Discretionary

C-13. SF139 – 6th St / NW Bypass Sfty (UPN 8623)

Offset of left turn lanes and upgrade signals and ADA ramps.

- **Estimated Cost: $**489,700
- **Funding Source:** HSIP/MACI – Discretionary

C-14. SF169 I-15 HT Cable Rail (UPN 9376)

High tension median barrier rail between Vaughn and Central Ave W on I-15.

- **Estimated Cost: $**1,790,310
- **Funding Source:** HSIP

C-15. Ulm – Great Falls (UPN 9589)

Pavement preservation on Ulm Frontage Road from Ulm to Gore Hill Interchange.

- **Estimated Cost: $**1,700,322
- **Funding Source:** IM

C-16. Fox Farm Road – West (I-315) (UPN 9590)

Pavement preservation on I-315 from Fox Farm Road to I-15.

- **Estimated Cost: $**1,456,334
- **Funding Source:** IM

C-17. Stuckey Road (UPN 9532)

Pave gravel road and improve to rural standards within City Limits.

- **Estimated Cost: $**605,000
- **Funding Source:** MACI – Guaranteed

TOTAL COMMITTED PROJECTS = $18,841,000

4.2. Annual Programs

Annual allocations for various programs are identified in the Great Falls 2018-2022 TIP. These programs are included to account for typical annual expenditures that are typically less costly and more routine than stand-alone projects. An estimate of annual costs was also made for years beyond those identified in the TIP (2023-2038). Funding for these programs is not guaranteed and is determined on a case-by-case basis. Specific projects have yet to be identified for these programs. These programs are intended to identify funding needs for routine annual projects.

P-1. Durable Pavement Markings Program

Install markings on urban routes per City, County, and MDT.

- **Estimated Cost 2018-2022:** $250,000 ($50,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $750,000 ($50,000 annually for 15 years)
- **Possible Funding Source:** STPU

P-2. Urban System Maintenance Program (Local)

Perform chip seals, overlays and related maintenance activities on Urban Routes.

- **Estimated Cost 2018-2022:** $928,090 ($185,618 annually for 5 years)
- **Estimated Cost 2023-2038**: $2,625,000 ($175,000 annually for 15 years)
- **Possible Funding Source:** STPU

P-3. Operations & Maintenance (Local)

Operate and maintain federal-aid systems in the Great Falls area.

- **Estimated Cost 2018-2022:** $10,895,000 ($2,179,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $30,000,000 ($2,000,000 annually for 15 years)
- **Possible Funding Source:** O&M State, County, and City

P-4. Traffic Mitigation

Complete projects that help mitigate traffic congestion including, traffic signal synchronization, bicycle pedestrian projects, intersection improvements, travel demand management strategies, and traffic flow improvements.

- **Estimated Cost 2018-2022:** $1,250,000 ($250,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $3,750,000 ($250,000 annually for 15 years)
- **Possible Funding Source:** MACI - Discretionary

P-5. ADA Compliance

Complete projects that help make the transportation system compliant with the Americans with Disabilities Act. The *Great Falls Public Right of Way ADA Transition Plan* contains various information on design standards, a discussion on ADA compliance, and an inventory of the compliant and non-compliant ADA accommodations.

- **Estimated Cost 2018-2022:** $1,250,000 ($250,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $3,750,000 ($250,000 annually for 15 years)
- **Possible Funding Source:** MACI - Discretionary

P-6. Transportation Alternatives Projects

Complete non-motorized transportation projects or other eligible Transportation Alternatives projects.

- **Estimated Cost 2018-2022:** $1,000,000 ($200,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $3,000,000 ($200,000 annually for 15 years)
- **Possible Funding Source:** TA

P-7. Transit Operating Expense

General transit operating expenses.

- **Estimated Cost 2018-2022:** $14,325,000 ($2,865,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $42,975,000 ($2,865,000 annually for 15 years)
- **Possible Funding Source:** FTA Section 5307

P-8. Transit Capital Purchase

Acquire vehicles and related equipment.

- **Estimated Cost 2018-2022:** $198,000 ($39,600 annually for 5 years)
- **Estimated Cost 2023-2038**: $594,000 ($39,600 annually for 15 years)
- **Possible Funding Source:** TransADE

P-9. MDT-nominated HSIP Safety Projects

MDT evaluates safety trends and concerns on an annual basis. HSIP funds are apportioned to Montana for allocation to safety improvement projects that correct or improve a hazardous road location or feature, or address a highway safety problem. In the Great Falls planning area, MDT identifies potential HSIP projects and programs said projects on an as-needed basis. This program is intended to reflect this MDT-led activity and relies on historical expenditures for this effort as a basis for future expenditures.

- **Estimated Cost 2018-2022:** $1,000,000 ($200,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $2,250,000 ($150,000 annually for 15 years)
- **Possible Funding Source:** HSIP

P-10. MDT-nominated Pavement Preservation Projects

MDT performs a wide range of pavement preservation activities on MDT routes to include mill, overlay, seal and cover (S&C), chip seal (CS) and striping. Programming of these pavement preservation activities is dynamic and is included in MDTs normal work protocols. This program is intended to reflect MDTs continued efforts to complete pavement preservation activities and relies on historical expenditures for this effort as a basis for future expenditures.

- **Estimated Cost 2018-2022:** $7,785,355 ($1,557,071 annually for 5 years)
- **Estimated Cost 2023-2038**: $22,500,000 ($1,500,000 annually for 15 years)
- **Possible Funding Source:** NHPP

P-11: City Pavement Preservation Activities

A range of pavement preservation activities to include mill, overlay, seal and cover (S&C), chip seal (CS) and striping will be necessary over the planning horizon in some locations on various urban roadways. Great Falls has set aside a portion of their yearly budget to complete city pavement preservation activities. Various roadways in need of pavement preservation were identified by Great Falls Public Works for the 2014 LRTP. The annual allocation has been included in the budget for 2018-2038. Some of the projects may be buildable in shorter timeframes. Additionally, pavement preservation actions would not be necessary if subject roadways were part of another identified reconstruction project. If the projects listed below are completed in that timeframe other roadways may be nominated for this program. The projects are listed in priority, as determined by Great Falls Public Works, as follows:

1.	8th Ave N – 26th to 38th St N	Mill, overlay, S&C, Striping	$1,216,373
2.	38th St N – 6th Ave N to River Dr	Mill, overlay, S&C, Striping	$247,782
3.	26th St N - Central Ave to 8th Ave N	Mill, overlay, S&C, Striping	$273,395
4.	25th St N - Central Ave to River Dr N	Mill, overlay, S&C, Striping	$375,033
5.	6th St S - Central Ave to 10th Ave S	Mill, overlay, S&C, Striping	$405,829
6.	13th St S – 24th Ave S to 30th Ave S	Mill, overlay, S&C, Striping	$201,535
7.	Lower River Rd - Overlook Dr south to City limits	Mill, overlay, S&C, Striping	$540,475
8.	Central Ave W – 20th St SW to 27th St SW	Mill, overlay, S&C, Striping	$312,849
9.	Watson Coulee Rd - Vaughn Rd to NW Bypass	Mill, overlay, S&C, Striping	$102,410
10.	Sun River Rd – 14th St SW west to City limits	Mill, overlay, S&C, Striping	$354,151
11.	1st Ave S – 11th St to 14th St S	Mill, overlay, S&C, Striping	$94,360
12.	2nd Ave S – 9th St to 15th St S	Mill, overlay, S&C, Striping	$219,579
13.	Central Ave W – 27th St SW to 30th St SW	S&C, Striping	$17,522
14.	Giant Springs Rd - River Dr to City Limits	CS & S&C, Striping	$85,311
15.	Park Garden Rd - Fox Farm Rd to Flood Rd	CS & S&C, Striping	$32,671

- **Estimated Cost 2018-2022:** $2,500,000 ($500,000 annually for 5 years)
- **Estimated Cost 2023-2038**: $7,500,000 ($500,000 annually for 15 years)
- **Possible Funding Source:** UPP

TOTAL ANNUAL PROGRAMS (2018-2022) = $41,381,445
TOTAL ANNUAL PROGRAMS (2023-2038) =$119,697,000

4.3. Recommended Projects

During the preparation of the 2018 LRTP, a number of recommended projects, in addition to those not yet completed from the 2014 LRTP, were identified. Project cost estimates for the recommended projects are planning-level estimates. They are in anticipated year-of-expenditure dollars (using a yearly inflation factor of 3%) and include all project phases. Any project considered for advancement should undergo a current cost estimate, which would include an examination of site conditions and subsequent development of more detailed project scope. The identified projects are anticipated to be funded beyond 2022 and within the planning horizon (2038). The following recommended projects are not in any particular order with respect to priority:

R-1. River Drive N – 15th St N to 25th St N

This project was identified in the *River Drive Corridor Study* completed in 2016 and has been carried forward as a recommendation for the 2018 LRTP. This segment of River Drive North consists of multiple access points, businesses and a residential development on the south side of the roadway, and the River's Edge Trail on the north side. The existing traffic volume on this segment is 14,500 vpd with a projected 2035 volume of approximately 20,000 vpd. This area is constrained by terrain to the north and by the businesses to the south. Currently, parking occurs within the River Drive North right-of-way in undesignated areas. There are no parking leases in place between land owners and MDT which would allow parking within the right-of-way. An evaluation of parking provisions should occur during project development.

Reconstruction of this segment is envisioned to consist of one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations. Reconstruction would serve to improve safety and operations by removing turning vehicles from the traffic stream, improving roadway geometrics, and accommodating non-motorized users. The opportunity to expand the roadway is limited by terrain constraints west of 25th Street North. Near the business district, steep slopes exist to the north; near the Big Stack Mobile Home Court, steep slopes exist on both sides of the roadway. This option does include full reconstruction of the intersection with 25th Street North. The intersection is currently operating at a failing LOS during the peak hours and has a history of crash trends. A traffic signal and single lane roundabout are potential options for improving the intersection.

- **Estimated Cost:** $14,500,000
- **Possible Funding Source:** NHPP, HSIP, MACI, STPU

R-2. Fox Farm Intersection Improvements

This project was identified in the *I-15 Corridor Planning Study* completed in 2015 and has been carried forward as a recommendation for the 2018 LRTP. The Fox Farm intersection is a four-way, stop-controlled intersection between 10th Avenue South and Fox Farm Road. The intersection is projected to have a failing LOS during the peak hours. The length of the eastbound left-turn bay is approximately 200 feet, and it does not appear to provide enough vehicle storage. Lengthening the existing turn bay would improve storage for left-turning vehicles, however, the overall delay of the intersection would remain the same.

The northbound approach leg consists of a shared left-turn/through, dedicated through, and dedicated right-turn lane. Because of this configuration, the existing signal timing is split-phased in the northbound and southbound directions. Split-phased signal timing can result in inefficiencies for traffic movements. Ultimately, it would be desirable to provide a dedicated northbound left-turn lane so that the signal timing could be modified to increase efficiency. However, existing development constrains the width of the northbound approach leg.

In the interim, the delay of the intersection could be reduced by installing dual left-turn lanes along the eastbound approach leg. This configuration could be achieved by narrowing (or removing) the existing median separating the left-turn and through lanes on the eastbound approach leg.

- **Estimated Cost:** $100,000
- **Possible Funding Source:** MACI

R-3. Signal Modifications/Upgrades/Roundabout Control

It is recommended that the community work towards upgrading all traffic signal heads in the City as appropriate. Upgrades would include but not be limited to signal heads, pedestrian push buttons, pedestrian heads, LED upgrades, battery backup systems, etc. The size and location to be upgraded will vary and not necessarily be of a consistent type, but rather should consider the surrounding area and be sensitive to the context for which it will be used. Some locations may require a full intersection upgrade. In primarily industrial and/or commercial areas, a standard signal head, consistent with MDT standards, are appropriate. Roundabouts are also a form of intersection control that should be explored at some intersections, coincident to traffic signal evaluation.

- **Estimated Cost:** $270,000
- **Possible Funding Source:** MACI

R-4. Central Avenue W – 3rd St NW to 1st Ave N

It is recommended that this corridor and corresponding intersections undergo re-striping and intersection modifications. Possible improvements are listed below, however a detailed engineering analysis, with feasible recommendations, should be completed prior to any improvements being implemented. Potential improvements include the following:

Bridge Structure: The existing bridge is currently striped as a four-lane facility with very wide travel lanes. The bridge is sufficient in width to re-stripe to add two more lanes – making the facility a six-lane roadway. It is recommended that this be completed to accommodate the recommendations below at the adjoining intersections.

Central Avenue W / 3rd Street NW Intersection: This intersection will require some re-configuration on the south leg to improve level of service and operations. It is recommended that the south leg be re-striped to allow for a left turn lane, a combination through and right turn lane, and an exclusive right turn lane.

1st Avenue N / River Drive Intersection: This intersection will require modification on the north leg (i.e. River Drive). On the southbound leg, it is desirable to widen to the west slightly and provide for an exclusive right turn lane, a shared right turn / through lane, and an exclusive left turn lane.

1st Avenue N - River Dr to Park Dr): Re-stripe this segment of roadway to a six-lane principal arterial standard. The available width on the north side of the median is 35 feet. On the south side of the median, there is 33 feet (which is striped as 3 lanes at 11 feet each). The north side of the median should be re-striped at 12 feet, 11 feet, and 12 feet. This measure would improve traffic flow characteristics during the PM peak for vehicles using the intersection of 1st Avenue North / Park Drive.

Park Drive - 2nd Ave N to 1st Ave N): Re-stripe this segment of roadway to provide for a two lane roadway on Park Drive, south of 2nd Avenue North. Also provide a right turn only lane and a combined thru lane / right turn lane on the north leg of the intersection of 1st Avenue North and Park Drive. A designated left turn lane will also be required on the north leg, with applicable geometric modifications

to the south leg to line up the respective turning movements. Consider a modern roundabout at the intersection of 2nd Avenue North and Park Drive.

- **Estimated Cost:** $867,000
- **Possible Funding Source:** NHPP

R-5: 26th Street S – 24th Ave S to 33rd Ave S

This project includes two projects within the County that are grouped together due to their proximity. Funding for completion of these projects rests with Cascade County solely. These projects are as follows:

26th Street S - 24th Ave S to 33rd Ave S): This roadway exhibits rural roadway characteristics and has an extremely abrupt shoulder edge in many spots along this corridor. At a minimum, it is recommended to rebuild the shoulders in spot areas to flatten the fill slopes to benefit roadway safety and potential "run-off-the-road" vehicles. This project primarily relates to the east side of the roadway.

26th Street South and 33rd Avenue South: This intersection exhibits poor sight distance and modifications to all four legs should be made. Stop control of this intersection should be installed on the north and south leg (i.e. 26th Street South). The four legs should be modified to gain a suitable approach grade to the intersection.

- **Estimated Cost:** $478,000
- **Possible Funding Source:** COUNTY

R-6. Central Avenue / 9th Street Intersection

Modify the west leg of this intersection (i.e. Central Avenue) by lengthening the existing left-turn bay to provide more storage for eastbound left-turns onto 9th Street North. This will also improve thru-movements on the leg by eliminating the blockage caused by the lack of storage on the existing left-turn bay. This recommendation would require the removal of the angled parking on the north side of Central Avenue, directly west of 9th Street. Parallel parking could remain, however.

- **Estimated Cost:** $17,000
- **Possible Funding Source:** MACI

R-7. 25th Street S – 10th Ave S to 11th Ave S

Modify this one-block segment of 25th Street South to one-way in the southbound direction. The benefit of this is that traffic will be removed from the congested turning movements on 10th Avenue South, between 25th and 26th Streets. By modifying the one-block segment, the lane use on 25th Street South, just north of 10th Avenue South, can be modified to a southbound right-turn lane, a combination thru/left-turn lane, and a designated left turn lane. This will likely remove pressure on the eastbound right-turning movement at 10th Avenue South / 26th Street South, and free up more signal time for northbound traffic on 26th Street South. Before proceeding with this project as envisioned, a detailed traffic engineering study will be necessary to document operational benefits, costs, and other potential impacts.

- **Estimated Cost:** $23,000
- **Possible Funding Source:** STPU

R-8. 25th Avenue NE – Old Havre Hwy to 15th St N

Based on a recent MDT Traffic Control Study, it is recommended to make several improvements along 25th Avenue NE to improve safety and operational characteristics. The corridor is currently a five-lane typical section. The improvements recommended include, but are not limited to:

- Updating all crosswalk yield lines to "sawtooth" design;
- Moving stop bars on the 25th Avenue NE approaches closer to the edge of the north/south traveled way;
- Installing "Cross Traffic Does Not Stop" plaque on stop signs;
- Restriping the 25th Avenue NE corridor as a 3-lane roadway with shared-use paths to provide a consistent typical section between Old Havre Highway and 15th Street; and
- Narrow down 25th Avenue NE approaches to match 3-lane corridor width.

  - **Estimated Cost:** $338,000
  - **Possible Funding Source:** STPU

R-9. Emerson Junction Feasibility Study

Secure a local project sponsor to fund an operational analysis/feasibility study, conducted by a qualified traffic engineer, of the Emerson Junction Interchange which considers state and federal regulations including the *Interstate System Access Informational Guide* and Montana Transportation Commission Policy.

- **Estimated Cost:** $250,000
- **Possible Funding Source:** CITY

R-10. Gore Hill Interchange with Southbound Auxiliary Lane

Given projected employment and population growth in the area surrounding the airport, volumes exceeding the available capacity are expected. Modifications to the intersections are needed to improve the operations and capacity of this interchange. Due to the proximity of the four intersections, it is desirable to evaluate the intersections as a network rather than individually when analyzing potential improvements.

Additionally, the existing grade between the Gore Hill and the 10th Avenue South interchanges is 5 percent. The steep grade results in a mixture of varying vehicle types and speeds. A high percentage of vehicles travel between the two interchanges resulting in vehicle weaving and operational issues. Construction of a southbound auxiliary lane is recommended and should be completed in conjunction with the Gore Hill Interchange reconstruction.

- **Estimated Cost:** $10,900,000
- **Possible Funding Source:** NHPP, HSIP, MACI, NHPB

R-11. Fox Farm Road – Alder Dr to Park Garden Rd

It is recommended to re-stripe this roadway to a four-lane facility to accommodate existing traffic volumes, as well as projected future traffic volumes. It is recommended to remove on-street parking within this stretch of roadway. A parking lot to serve the adjacent Meadowlark Elementary School and Montana Park should be built west of the road to mitigate loss of on-street parking.

- **Estimated Cost:** $810,000
- **Possible Funding Source:** STPU

R-12. Giant Springs Road – Hatchery to Rainbow Dam

Overlay with new asphalt and widen as needed in existing narrow sections.

- **Estimated Cost:** $3,377,000
- **Possible Funding Source:** UPP

R-13. 9th Street NW – NW Bypass to Central Ave W

This roadway serves as an important north-south collector and is located in an urban setting. The roadway exhibits aging infrastructure. The roadway is very narrow and lacks consistent pedestrian facilities. Concerns have been expressed from the public on the removal of on-street parking along the route, especially closer to NW Bypass. Increased traffic on this roadway is expected so it is recommended that this roadway be reconstructed to a collector street standard.

- **Estimated Cost:** $5,177,000

TOTAL RECOMMENDED PROJECTS = $37,107,000

4.4. Illustrative (Unfunded) Projects

System deficiencies and needs are often not fundable in the foreseeable future. However, funding opportunities often arise over time, often from unexpected sources. To be prepared to take advantage of such opportunities, the following list of projects is provided, with no identified funding source or schedule for construction/implementation. While the project costs have been estimated, most are presented in a 2038 year-of-expenditure, using a 3% yearly inflation rate to reach year-of-expenditure. Such projects are included for illustration purposes only, and are not considered to be applicable components of the fiscal constraint requirements of the LRTP. However, it is likely that some of them will become funded at some point during the 20-year planning horizon even though no current source is known.

I-1. 40th Avenue S – Upper River Rd to 13th St

It is recommended that this piece of roadway be overlaid with new asphalt. This project was contained in the past transportation plan for Great Falls.

- **Estimated Cost:** $2,926,000

I-2. Franklin Avenue – Lower River Rd to 13th St

It is recommended that this piece of roadway be overlaid with new asphalt. This project was contained in the past transportation plan for Great Falls.

- **Estimated Cost:** $1,688,000

I-3. Wilson Butte Road – Eden Rd to LRTP boundary

It is recommended that poor sections on this piece of roadway be overlaid with new asphalt.

- **Estimated Cost:** $2,251,000

I-4. Upper River Road – 19th Ave S to 40th Ave S

It is recommended that poor sections on this piece of roadway be overlaid with new asphalt. This project was contained in the past transportation plan for Great Falls.

- **Estimated Cost:** $4,615,000

I-5. 33rd Avenue S / 13th Street S Intersection

This intersection exhibits poor sight distance and modifications to the intersection legs should be made. Specifically, intersection should be reconfigured to a conventional “T” intersection with stop control on the east leg (33rd Avenue South). In addition, a detailed sight distance study should be completed to examine improvements to the north leg of 13th Street South.

- **Estimated Cost:** $163,000

I-6. 36th Avenue NE Traffic Calming

Until a future project north of Great Falls can be completed to establish a grid street network in the newly developing areas, 36th Avenue NE will continue to encounter the effects of increasing traffic, higher travel speeds, and peak travel demands. Due to the width of the roadway and the aforementioned concerns, traffic calming along the route should be implemented. The purpose of the traffic calming is to slow travel speeds by giving the appearance of "pinch-points", and to increase the visibility of pedestrians in the area. Curb bulb-outs placed at the major north-south routes that intersect with 36th Avenue NE should be considered, and an evaluation of stop sign control warrants should periodically be made. The likely candidates for curb bulb-outs on 36th Avenue NE include the following intersections: 2nd Street NE; 4th Street NE; 7th Street NE; and 9th Street NE.

- **Estimated Cost:** $113,000

I-7. 25th Avenue NE / 8th Street NE Intersection

Poor levels of service under existing and projected conditions suggest a four-way stop control be appropriate at this intersection to better meter traffic and provide gaps for the various traffic movements. Four-way stop control would also help pedestrian crossing activity in front of the middle school by allowing gaps for pedestrians to be created.

- **Estimated Cost:** $28,000

I-8. 11th Avenue S Traffic Calming

It is recommended to provide aggressive traffic calming on 11th Avenue South, between 26th Street South and 32nd Street South, to heighten pedestrian visibility and slow traffic down. Traffic calming may include a combination of curb bulb-outs and/or raised speed tables at the major intersections.

- **Estimated Cost:** $84,000

I-9. 11th Avenue S / 32nd Street S Intersection

Continue to monitor this intersection for 4-way stop control. It is presently stop-sign controlled on the south and north legs (i.e. 32nd Street South). With future connectivity improvements (i.e. the extension of 15th Avenue South to 32nd Street South) recommended later in the LRTP, the intersection may see an increase in volume on 32nd Street South that may meet 4-way stop control warrants.

- **Estimated Cost:** $11,000

I-10. Speed Studies

Several segments of roads may be ideal candidates for periodic speed studies. These include Central Avenue West (from 9th Street NW to 20th Street NW); 3rd Street SW / 4th Avenue SW (from Central Ave West to 6th Street SW); and 36th Avenue NE.

- **Estimated Cost:** $39,000

I-11. Signal Warrant Analysis

A number of intersections should be periodically checked for signal warrants as development and projects occur around the community. These intersections include: the north and west sides of the airport interchange; the intersection of Central Avenue West and Vaughn Road; Fox Farm Road and Park Garden Road; Fox Farm Road and 18th Avenue SW; 3rd Avenue South and River Drive; 6th Street SW and 4th Avenue SW; 38th Street and Central Avenue; and other locations as the need may arise.

- **Estimated Cost:** $214,000

I-12. 38th Street N – 10th Ave N to River Dr N

Narrow width and increased traffic, as well as truck traffic, suggests this segment would function better as an urban collector. It is the only segment on the 38th Street North collector corridor that is not an urban standard. It is recommended that this roadway be reconstructed to collector street standard.

- **Estimated Cost:** $3,827,000

I-13. Flood Road – Park Garden Rd to Dick Rd

This roadway has limited capacity, is very narrow, and is expected to see traffic increases. It is recommended that this roadway be reconstructed to a collector street standard.

- **Estimated Cost:** $22,510,000

I-14. 6th Street NW – Smelter Ave to 36th Ave NE

This roadway is currently very narrow and lacks shoulders. Poor sight distance is noted in some locations along the roadway. Reconstruct to a collector street standard with urban roadway features (such as curb & gutter, lighting, sidewalks, etc.). Consider extension north of Skyline Drive to 36th Avenue Northeast to accommodate development in this area of the City.

- **Estimated Cost:** $9,679,000

I-15. Watson Coulee Road – NW Bypass to Vaughn Rd

Aging infrastructure, lack of pedestrian facilities, traffic mixture, termini geometrics are noted as problems on Watson Coulee Road. This roadway generally has curb and gutter on both sides, but no sidewalks. The roadway surfacing is in varying states of deterioration. Reconstruction of this roadway to bring up to current standards would improve this north-south link on the western edge of the city limits. It is recommended that this roadway be reconstructed to a collector street standard.

- **Estimated Cost:** $3,039,000

I-16. River Drive – 3rd Ave S to 1st Ave N

This roadway is narrow with several curves and is approaching capacity under existing conditions. Reconstruct to minor arterial standards, along with a railroad underpass, in conjunction with intersection improvements at the intersection of 1st Avenue North and River Drive. Perform signal warrant analysis at the intersection of River Drive and 3rd Avenue South periodically as development infill occurs. This corridor is extremely important to the users of the River's Edge Trail and to connecting downtown with the riverfront and hotels on the riverfront with downtown. It is suggested that the access to the Broadwater Bay Park, across from the Applebee's Restaurant, be closed to improve traffic flow in the area. Also, access control along the corridor should be reviewed periodically, as more development occurs to the south of 3rd Avenue South.

- **Estimated Cost:** $12,831,000

I-17. Park Drive – 8th Ave N to 2nd Ave N

This roadway is narrow with several curves. There are also concerns for safe pedestrian crossing across Park Drive. Reconstruct to collector street standards. Particular focus should be given to the intersection of Park Drive/6th Street North/8th Avenue North for a more standard intersection design that may better define the use in the intersection. In addition to the standard treatments, a modern "roundabout" should be evaluated at this location. Ample right-of-way appears to be available to accommodate a roundabout configuration. Potential pedestrian improvements should be included in the project, including additional marked crosswalks across Park Drive to connect the neighborhoods to Gibson Park. Although the overall project may not be a high priority given other Great Falls area needs, individual improvements could be

contemplated and phased over time. Improvements for pedestrian access and to the 3-way intersection, as well as curb and gutter improvements, could be considered at lower costs.

- **Estimated Cost:** $6,783,000

I-18. Central Avenue W – 20th St NW to 29th St NW

This facility lacks shoulders and does not fit within the context of the community. Existing curb, gutter, and sidewalks terminate at 20th St SW just west of the Central Ave W / I-15 interchange. It is recommended that this roadway be reconstructed to collector street standards.

- **Estimated Cost:** $7,879,000

I-19. 21st Avenue S

Construct 21st Avenue South, between 23rd Street South and 26th Street South, to a two-lane collector street standard.

- **Estimated Cost:** $2,251,000

I-20. 67th Street N – Giant Springs Rd to 18th Ave N

Reconstruct portion of 67th Street North to paved roadway to match Giant Springs Road to the west. Rural, local roadway section is applicable for this roadway.

- **Estimated Cost:** $8,892,000

I-21. Sun River Road – Urban Boundary to 14th St SW

Overlay with new asphalt, and also reconstruct as needed in sections with poor pavement conditions. There are also several narrow sections along this corridor that should be widened.

- **Estimated Cost:** $5,740,000

I-22. Upper River Road – Overlook Dr to 19th Ave S

This facility lacks shoulders and does not fit within the context of the community. Existing curb, gutter, and pedestrian facilities terminate at Overlook Drive. Reconstruct to a collector street standard.

- **Estimated Cost:** $6,753,000

I-23. 17th Avenue S – 7th St S to 13th St S

This facility has limited capacity and does not fit within the context of the community. It is recommended that this roadway be reconstructed to collector street standards. Note that 17th Ave S from 9th St S to 13th St S is an urban route and a local route from 7th St S to 9th St S.

- **Estimated Cost:** $4,840,000

I-24. 36th Avenue NE – 1st St NE to 6th St NW

Extend 36th Avenue NE from its present termini (~350 feet west of 1st Street NE) to the intersection with 6th Street NW. Completion of this segment will allow traffic to better distribute throughout the surrounding neighborhood. This link can only be accomplished with the help of willing landowners upon which the route would be considered. This segment should be built to a collector standard to match existing roadway geometrics.

- **Estimated Cost:** $4,502,000

I-25. 15th Avenue S – 30th St S to 32nd St S

Extend 15th Avenue South from its current termini (near the theoretical extension of 30th Street South) eastward to connect to 14th Avenue South, at 32nd Street South. This segment should be built to a collector standard.

- **Estimated Cost:** $1,351,000

I-26. 43rd Avenue NE – Bootlegger Trail to 6th St NW

Construct a new roadway along the theoretical alignment of 43rd Avenue NE, between Bootlegger Trail (eastern termini) and 6th Street NW (western termini). This route should be built to a minor arterial standard with limited access control, and can only be accomplished with the help of willing landowners upon which the route would be considered. This could occur during individual property development phases, or all at once. As development leap frogs to the north of Great Falls, a new east-west collector route will be necessary to distribute traffic from local, neighborhood roads to area arterials.

- **Estimated Cost:** $19,134,000

I-27. 43rd Avenue NE – Bootlegger Trail and US 87

Construct a new roadway segment along the theoretical alignment of 43rd Avenue NE, between Bootlegger Trail (western termini) and US 87(eastern termini). This route should be built to a minor arterial standard with limited access control, and can only be accomplished with the help of willing landowners upon which the route would be considered.

- **Estimated Cost:** $2,983,000

I-28. North / South Connectors

Extend existing north-south routes from north of 36th Avenue NE to the new 44th Avenue NE to complete a gridded network of roads. Routes envisioned for future connections include the following: 2nd Street NE; 4th Street NE; 7th Street NE; and 9th Street NE.

- **Estimated Cost:** $9,904,000

I-29. 25th Street N – River Dr to 2nd Ave N

Reconstruct to a minor arterial street standard. The roadway currently exhibits a mixture of urban and rural road characteristics – i.e. curb and gutter, sidewalk, lighting, etc. It is desirable to reconstruct the road to an urban minor arterial to accommodate increasing traffic, provide better non-motorized facilities and connectivity, and plan for the varied uses in the area (Centene Park, Pasta Montana, General Mills, etc.). The project would require a new bridge crossing of the railroad (estimated size is 100 feet long by 80 feet wide; planning level cost is $150 per square foot). The intersection of 25th Street North and River Drive North should be reconstructed with consideration for either traffic signalization or a modern roundabout. Both treatments may be difficult due to the grade of River Drive North, to the west of 25th Street North.

- **Estimated Cost:** $12,155,000

I-30. 10th Avenue S – 26th St S to 32nd St S

There are both existing and future capacity concerns on this roadway due to increasing traffic. Widen to a six-lane principal arterial standard, including sidewalks. Expansion to a six-lane facility will provide typical section continuity to match roadway sections in place west of 26th Street South.

- **Estimated Cost:** $12,943,000

I-31. Downtown Traffic Flow Conversion

Modify 1st and 2nd Avenues South, and 5th and 6th Streets, to maintain one-way traffic flow, but reduce typical section by one vehicle lane to accommodate new on-street bicycle facilities (see *Downtown Access, Circulation and Streetscape Plan - April 2013*). The existing 3-lane sections of 1st Avenue South, 2nd Avenue South, 5th Street and 6th Street in the downtown area provides traffic capacity in excess of that needed to adequately accommodate existing and forecast traffic volumes. Areas of modification are as follows:

- 1st Avenue South (between Park Drive and 10th Street South
- 2nd Avenue South (between Park Drive and 7th Street South
- 5th Street (North and South) between 2nd Avenue North and 6th Avenue South
- 6th Street (North and South) between 2nd Avenue North and 5th Avenue South

- **Estimated Cost:** $225,000

I-32. 20th Street S – 17th Ave S to 24th Ave S

Extend 20th Street South from 17th Avenue South to 24th Avenue South. Build to a collector standard. This can only be accomplished with the help of willing landowners upon which the route would be considered. This extension would require the acquisition of a private parcel with several outbuildings in the vicinity of 18th Avenue South.

- **Estimated Cost:** $4,389,000

I-33. 23rd St S – 21st Ave S to 24th Ave S

Extend 23th Street South from 21st Avenue South to 24th Avenue South. Build to a collector standard, and can only be accomplished with the help of willing landowners upon which the route would be considered.

- **Estimated Cost:** $1,835,00

I-34. Wilson Butte Road / 55th Avenue S / Eden Road / Lower River Road

It is recommended that this intersection be reconfigured with a modern roundabout to better define geometrics and control turning movements through the intersection.

- **Estimated Cost:** $371,000

I-35. 26th Street N – 8th Ave N to 2nd Ave N

Noted concerns on this roadway include limited capacity; narrow roadway facility; and lack of consistent pedestrian facilities. Reconstruct to a minor arterial street standard. The roadway currently exhibits a mixture of urban and rural road characteristics – i.e. curb and gutter, sidewalk, lighting, etc. It is desirable to reconstruct the road to an urban minor arterial to accommodate increasing traffic, provide better non-motorized facilities and connectivity, and plan for the varied uses in the area.

- **Estimated Cost:** $7,203,000

I-36. Vaughn Road – Interstate 15 to Central Ave W

Reconstruct Vaughn Road to a principal arterial street standard. Justification for the project includes limited future capacity, an existing narrow roadway facility, and the presence of heavy truck traffic. The project envisioned is approximately 2.24 miles in length. The influence of a potential “full movement” interchange (see I-39) may necessitate evaluating both projects (i.e. I-39 and I-40) in tandem to determine potential impacts and project limits.

- **Estimated Cost:** $16,995,000

I-37. River Drive N – 25th St N to 38th St N

This segment of River Drive North consists of limited access points, higher speeds, and lower traffic volumes than Segment 1 (R-12). Reconstruction is envisioned to consist of one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations. Reconstruction would improve safety and operations by removing turning vehicles from the traffic stream, improving roadway geometrics, and accommodating non-motorized users. Unlike Segment 1 (R-12), there are likely fewer locations where a center left-turn lane is needed due to less access points and approaches.

- **Estimated Cost:** $11,800,000

I-38. US 87 – Old Havre Hwy / 33rd Ave NE to Bootlegger Trail

Reconstruct the area between Old Havre Highway / 33rd Avenue NE and Bootlegger Trail. A detailed traffic engineering analysis should be completed before implementing any improvements. The following measures should be explored to mitigate existing and future traffic concerns:

Intersection of Old Havre Highway / 33rd Avenue NE and 15th Street NE: Reconfigure by eliminating the skew of Old Havre Highway to line up directly opposite the 33rd Avenue NE leg. The reconfigured intersection would have a combined LT/TH/RT-turn lane on the 33rd Avenue NE leg, a combined LT/TH and a separate channelized RT on the Old Havre Highway leg, and two thru lanes with left-turn bays on both legs of 15th Street NE. Also, a SB right-turn "slip-lane" would be created via an additional third lane between Bootlegger Trail and Old Havre Highway.

Southbound Lane: Add a third southbound lane between Bootlegger Trail and Old Havre Highway. This new third lane would allow a swift exit off of Bootlegger Trail in a southerly direction to a new slip lane at Old Havre Highway.

Intersection of Bootlegger Trail and US 87: Reconfigure by creating a raised channelization island to separate SB right-turns off Bootlegger Trail from NB left turns.

- **Estimated Cost:** $5,628,000

TOTAL ILLUSTRATIVE PROJECTS = $218,544,000

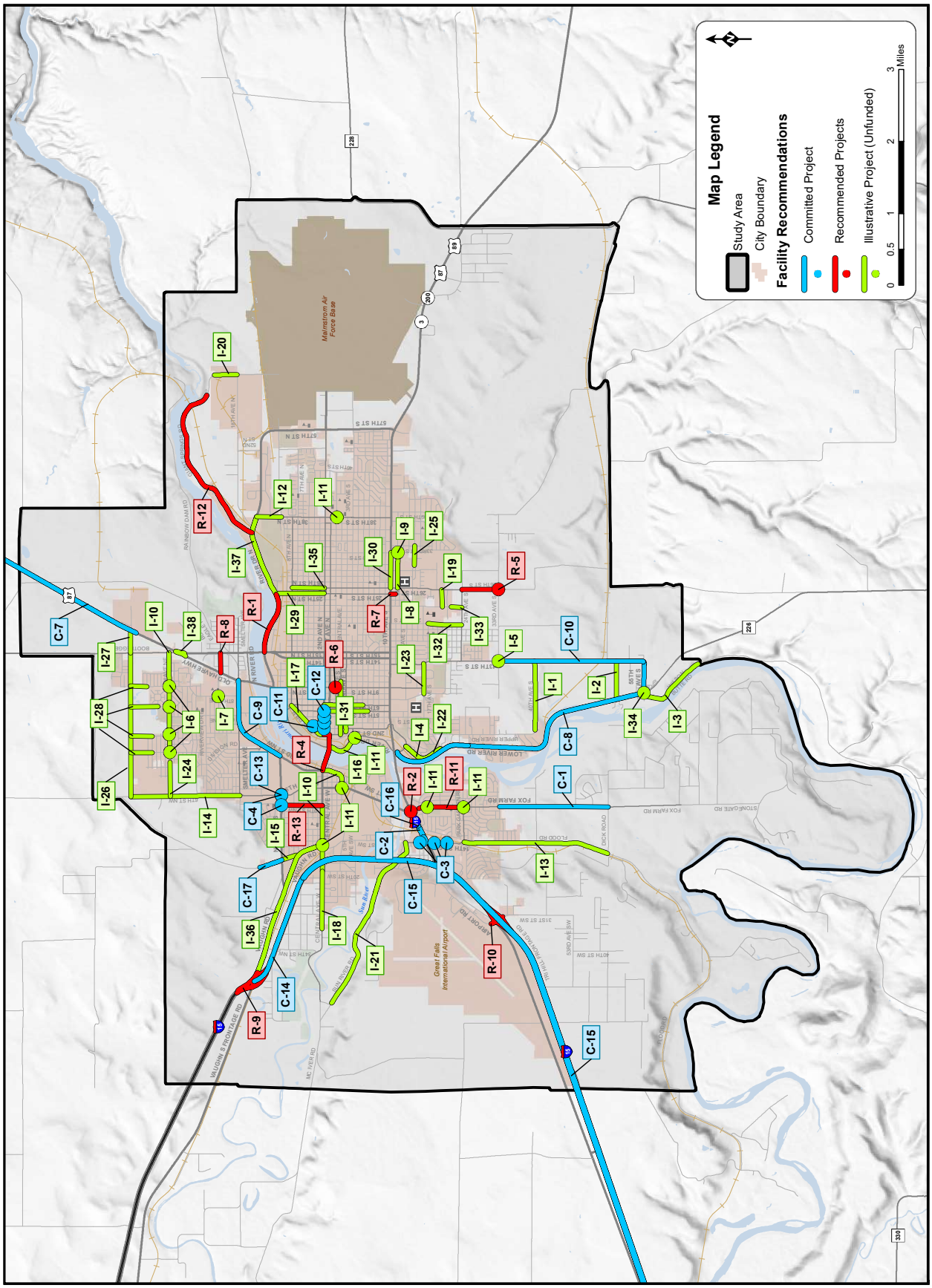


Figure 1: Facility Recommendations

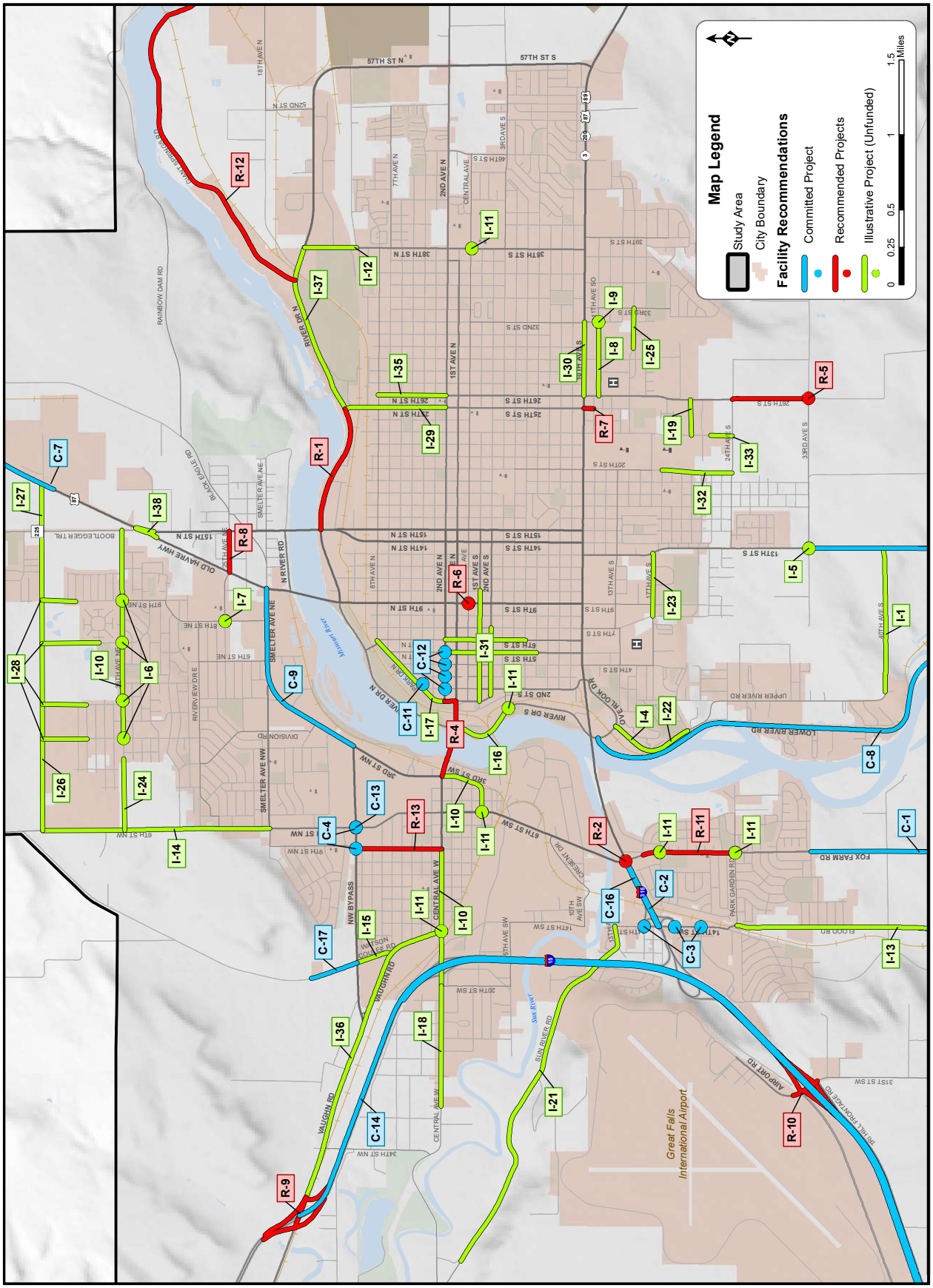


Figure 2: Facility Recommendations - Detail Area

5.0 NON-MOTORIZED NEEDS AND RECOMMENDATIONS

This section outlines priority issues and proposed recommendations for improving walking and bicycling in the Great Falls area based on analysis of deficiencies, crash data, public input (survey responses and open house comments), and overall opportunities and constraints in the Great Falls area.

5.1. Great Falls Transportation Improvement Program FFY 2018-22

The Great Falls TIP includes review of projects related to walking and bicycling that have been completed since 2013 and which are planned for implementation during the Federal Fiscal Years (FFY) of 2018 to 2022. **Table 4** shows those projects that were completed, in progress, and upcoming. Note that the Park Dr/4th Ave N Pedestrian Crossing project listed in **Table 4** is a "committed" project, indicating that funds have been programmed and allocated for implementation.

Table 4: Great Falls Area TIP FFY 2018-2022 Bicycle and Pedestrian Projects

Category	Project	FFY	Description	Funding Agency	Total Cost	Status
Pedestrian Only	1st Ave N	2013	Sidewalks/Ramps 25th-38th Sts	State/Federal	$176,200	**COMPLETE**
Pedestrian Only	2nd Ave N	2013	Sidewalks/Ramps 15th-37th Sts	State/Federal	$306,800	**COMPLETE**
Pedestrian and Disability	1st Ave N/2nd Ave N	2014	Curb Ramps/Pavement Preservation	State/Federal	$964,319	**COMPLETE**
Pedestrian and Disability	9th St N	2014	Pavement Preservation/ADA	State/Federal	$1,174,371	**COMPLETE** Not Closed
Bicycling and Pedestrian	Sun River Connector Trail	2015	Bike/ped facility adjoining Country Club Blvd. from Warden Bridge to Bike/ped facility at 6th St SW	CMAQ	$2,469,470	**COMPLETE** Not Closed
Bicycling and Pedestrian	Overlook Drive Sidewalk/Trail	2015	Sidewalk/trail from 10th Ave S to vicinity of Visitor's Center	TA	$810,988	**COMPLETE** Not Closed
Bicycling and Pedestrian	West Bank Park Trail ADA Improvements	2015	Trail widening, ADA connection in West Bank Park	TA	$272,710	**COMPLETE** Not Closed
Pedestrian only	Great Falls Sidewalk Infill Project	2018	Sidewalks-various locations	CMAQ	$483,000	**IN PROGRESS**
Bicycling and Pedestrian	Park Dr/4th Ave N Ped Xing-GTF	2019	Pedestrian/Bicycle crossing improvement	TA	$307,529	**COMMITTED** (**C-11**)

TOTAL COST OF BICYCLING AND PEDESTRIAN PROJECTS (2013-2019): $6,965,387

5.2. Pedestrian Improvements

This section outlines potential active transportation facilities relative to sidewalks, street crossings, and natural surface trails. The recommendations are intended to encourage active living by residents and visitors and accommodate a variety of ability levels with particular emphasis on establishing a well-connected pedestrian network that is comfortable and accessible to a wider range of the population. Priority issues and proposed recommendations are based on analysis of deficiencies, crash data, public input, and overall opportunities and constraints in the Great Falls area.

5.2.1. Overview

All residents within the Great Falls area are pedestrians at some point in their day – whether walking the dog, walking to the store or work, or from a vehicle to a final destination. This section includes pedestrian needs, system deficiencies, needs of those with disabilities or limited mobility, observation and recommendation development methodology, and proposed recommendations for pedestrian facility improvements that were developed from the public involvement process and from field observations.

Even though the River's Edge Trail provides a high-quality backbone to the Great Falls non-motorized transportation system, it lacks frequent neighborhood connections and its location does not make the trail a viable option for most utilitarian walking trips. The trail is typically the destination for the majority of its users. This, in addition to sidewalk network gaps (in areas of the city) and the attitude and perception of motorists towards non-motorized modes (such a low yielding rates to pedestrians in crosswalks) pose additional challenges to increased rates of walking.

5.2.2. Pedestrian Needs

People walk for various reasons and needs vary, often depending on trip purpose. All pedestrians share some common needs including safety, connectivity, and accessibility (especially for persons with disabilities). Senior citizens and mobility-impaired pedestrians may lack motorized transportation options and may consequently depend on transit and pedestrian-focused aspects of the transportation network.

Needs of Pedestrians with Disabilities

To adequately plan for pedestrians with disabilities, each disability and its corresponding limitations should be considered. It is important to also be aware of how planning for people with one disability may affect users with other impairments.

People with mobility impairments range from those who use wheelchairs, crutches, canes, orthotics, prosthetic devices, and face constraints. Uneven or rough surfaces that hinder movement or narrow surfaces that make maneuvering and rolling difficult, and steep uphill, downhill, and cross slopes are common obstacles for disabled users. Walking-aid users are most affected by the above mentioned obstacles, as well as long distances between crossing opportunities and situations that require fast reaction time.

Visually-impaired people (those who are partially or full blind or deaf, those with limited perceptions of touch or balance, and those with color blindness) face difficulties with lack of depth perception, information about their surroundings, and non-visual information; the inability to react quickly; complex intersections; and detection of street crossing timing.

Hearing-impaired pedestrians rely on visual information. Their primary mobility difficulties include the inability to hear approaching vehicles and detect the time of their arrival. This is especially an issue in locations with limited sight distances, such as curved street segments, or overgrown vegetation impeding sight lines.

People with cognitive impairments encounter difficulties in thinking, learning, responding, and performing coordinated motor skills and these impairments can cause some to experience difficulty finding their way. They may also not understand standard street signage, and may be unable to read and benefit from signs with symbols and colors.

Each proposed facility must be designed in accordance with the Americans with Disabilities Act (ADA) design standards.

Children and the Elderly

Children are less mentally and physically developed than adults, and often have limited peripheral vision and less ability to judge speed and distance, locating sounds and comprehending street signs, they lack familiarity with traffic, and may act impulsively or unpredictably.

Older adults often exhibit degrading sensory or physical capabilities. This can lead to loss of vision and hearing, the ability to react quickly, and the strength to walk otherwise normal distances between places.

Similar to designing walking facilities for users with disabilities, similar consideration should be given to young and elderly users.

5.2.3. Recommended Improvement Methodology

Pedestrian network improvements have been selected to close gaps in the network, make connections to and from major destinations, and improve overall comfort and sense of security for pedestrians.

Improvements to the pedestrian network will occur over time along the major street network in the Great Falls Area as part of roadway improvement projects, signal upgrade projects and as standalone pedestrian focused projects. In residential areas improvements could occur as part of a coordinated sidewalk program or as standalone publicly funded projects using sources like the Transportation Alternatives Program.

Sidewalk Program

Sidewalk construction, management, and maintenance programs help renew and expand sidewalk networks that, due to myriad reasons, are currently fragmented, disconnected, or poorly maintained. Many Montana communities, including Great Falls, have programs for repairing aging sidewalk infrastructure; however, fewer communities have programs for funding or financing the installation of new sidewalk.

It is recommended that a solid funding source of at least $50,000 annually be provided to match property owners' costs in a 50/50 cost share split. This program is a model that splits the cost of sidewalk replacement and/or construction between the property owner and the local agency. The source of funding can vary, but is typically a defined item in the agency's annual budget. Funding sources can be diverse and do not necessarily have to come directly from the City's revenue; they can include federal funding, voter-approved taxed or bond measures, fuel taxes, parking tolls, and others. Other cities around Montana utilize a variety of methods including low cost or no interest loans to property owners, adding the expense to street assessments, Special Improvement Districts, and Missoula's 'health plan' style approach where the city provides a minimum level of support and provides property owners with a maximum contribution independent of lot size.

Smaller cities in Montana have a smaller tax base and the total amount of funding (and therefore the amount of sidewalk management and maintenance that can be done) is less than larger cities like Missoula and Billings. For example, Kalispell's FY 2013 general fund appropriation was approximately

$40,000 for sidewalk replacement only, while Missoula's was between $500,000 and $800,000 for new sidewalk construction. Great Falls may wish to increase funding over time if the sidewalk program is successful. **Table 5** presents suggested sidewalk program elements for consideration.

Table 5: Sidewalk Program Elements

Target	Notes
Coordinating Agency and Partners	City of Great Falls Public Works Department
Key Elements	Cost sharing, sidewalk replacement and expansion policies, and City budget appropriation
Timeframe	On-going
Potential Funding Sources	Property owners; City of Great Falls; MDT
Sample Programs	Missoula, MT; Kalispell, MT

5.2.4. Recommended Facilities

This section includes all recommended facilities for pedestrian travel. Pedestrian network improvements are depicted graphically in **Figure 3**.

Sidewalks

Completing the sidewalk network gaps on the major street network will allow more predictable trips for pedestrians and will improve the overall connectivity of the Great Falls area.

Table 6: Recommended Sidewalks

ID	Location	Description	Length (miles)	Estimated Cost
SW-1	**4th St S** *13th Ave S to 12th Ave S*	Close gap in sidewalk.	0.02	$5,100
SW-2	**4th St S** *10th Ave S to 12th Ave S*	Sidewalk gap on parcel of land between Pro Lube and Holiday Inn. This could be completed with new development in the future.	0.02	$6,800
SW-3	**6th St N** *River's Edge Trail to 8th Ave N*	There is need for a connection to River's Edge Trail from the neighborhoods. There are ample goat trails in this area showing established use. The road could be converted to one lane through the bridges with a directional yield scenario.	0.05	$15,200
SW-4	**17th Ave NE** *River's Edge Trail to 3rd St NW*	Connect existing sidewalk to River's Edge Trailhead.	0.15	$43,200
SW-5	**16th Ave NW / 1st St NW** *16th Ave NW to 17th Ave NW*	Fill gap in existing sidewalk on 16th Ave NW and 1st St NW. This will connect businesses in the area.	0.07	$20,600
SW-6	**Division Rd** *16th Ave NW to Smelter Ave NE*	Sidewalk is unlikely to be added with new development.	0.16	$46,400
SW-7	**8th Street NE and Sacajawea Dr** *South of Baseball Field to West of Baseball Field*	Fill in sidewalk gap around the baseball field. Only 8th Street NE is on the major street network, but the entire length of sidewalk could be a Transportation Alternatives project.	0.14	$41,900
SW-8	**NW Bypass** *9th St NW to 6th St NW*	Retrofit needed to close sidewalk gap.	0.06	$18,000
SW-9	**9th St NE** *32nd Ave NE to 33rd Ave NE*	Close gap in sidewalk on both sides of the street.	0.02	$3,800
SW-10	**36th Ave NE** *5th St NE to 6th St NE*	Construct sidewalk around park perimeter on 36th Ave NE. Fills gap and provides a greater hard edge to the park.	0.09	$26,700

ID	Location	Description	Length (miles)	Estimated Cost
SW-11	**15th St N** *Railroad to River Drive*	Large gaps on the east side of the street.	0.08	$24,200
SW-12	**15th St N** *8th Ave N to 10th Ave N*	Close gap in sidewalk as this path may eventually access River's Edge trail. Large goat trails are already present.	0.1	$30,000
SW-13	**14th St N** *8th Ave N to 12th Ave N*	Large gaps on west side of roadway.	0.21	$61,300
SW-14	**NW Bypass** *Stuckey Road to 9th St NW*	Install sidewalks on both sides of roadway, there are currently no sidewalks on this route.	0.74	$220,200
SW-15	**3rd Ave S** *46th St S to 51st St S*	Most of these lots are developed and may not redevelop. Sidewalks should be retrofitted.	0.22	$65,900
SW-16	**4th St S** *15th Ave S to 13th Ave S*	Gap in sidewalk exists over 3 parcels, two of which are already developed.	0.05	$14,300
SW-17	**4th St S** *16th Ave S to 17th Ave S*	Sidewalk gap along one side of residential lot.	0.01	$2,800
SW-18	**4th St S** *17th Ave S to 18th Ave S*	Sidewalk gap along one side of residential lot.	0.02	$5,600
SW-19	**23rd Ave NE** *Division Road to 4th St NE*	Provides a sidewalk connection to Jaycee Park (pool) and helps get people from their cars to the front door. Also connects to new crosswalk.	0.19	$56,100
SW-20	**13th Ave S** *5th St S to 7th St S*	Sidewalk gaps exist and about half of corridor is already developed. This is low priority as the south side of the road already has sidewalks.	0.15	$45,600
SW-21	**7th St S** *10th Ave S to 13th Ave S*	Sidewalk gaps exists over developed parcels on both sides of the street. Will need some access control.	0.09	$28,000
SW-22	**13th Ave S** *7th St S to 9th St S*	Discontinuity in sidewalk in front of ERA American Horizon. Modifications should be made to make this continuous for pedestrians.	0.03	$9,700
SW-23	**5th Ave NW** *9th St NW to 6th St NW*	Complete sidewalks on both sides of the street.	0.17	$49,800

TOTAL SIDEWALK PROJECTS: $841,200

5.3. Bicycle Improvements

This section outlines potential active transportation facilities relative to shared lane markings, bike lanes, shared use paths, and other spot improvements. The recommendations are intended to encourage active living by residents and visitors and accommodate a variety of ability levels with particular emphasis on establishing a well-connected bicycling network that is comfortable and accessible to a wider range of the population. Priority issues and proposed recommendations are based on analysis of deficiencies, crash data, public input, and overall opportunities and constraints in the Great Falls area.

5.3.1. Overview

Improving the on- and off-street bicycling network will provide cohesive connections between destinations and will contribute to the viability of the bicycle as a transportation mode choice. Although the existing roadway network does not preclude bicycle use, connectivity needs to be accounted for when considering bicycle features.

The on-street network of bicycle facilities is largely undeveloped; there is significant potential to create rapid expansion with much apparent 'low-hanging fruit. As it is for pedestrians, the River's Edge Trail is a high-quality backbone to the Great Falls bicycling network, but the trail's relatively few neighborhood

connections and location does not make it as attractive for most utilitarian bicycling trips and the trail is typically a destination for the majority of its users.

5.3.2. Policy and Program Recommendations

While improving walking and bicycling infrastructure is a vital component to increasing active transportation use, supportive programs and policies are a cost-effective complement and their impact should not be underestimated. Working directly with the public to encourage walking and bicycling can increase use of those modes, improve road safety, and strengthen the role of bicycling as a tourism generator in the Great Falls area. This section describes current efforts and future recommendations related to these programs and policies. The goals of these recommendations are to:

- Increase the visibility and legitimacy of bicycling and bicyclists in the Great Falls area;
- Support and enhance the infrastructure recommendations in this Plan; and
- Increase the number, safety, and comfort of people walking in the Great Falls area.

BICYCLE AND PEDESTRIAN ADVISORY COMMITTEE (BPAC)

A Bicycle and Pedestrian Advisory Committee (BPAC) is made of citizen volunteers to advise the community leaders on bicycling and pedestrian issues and to make recommendations for Transportation Alternatives and other grant applications. The BPAC establishes the area's commitment to making bicycling and walking safer and more desirable, and has the potential to assist the City in securing funding for bicycle and pedestrian projects. Having an established BPAC is also desirable for receiving Bicycle or Walk Friendly Communities designation.

The charges of the BPAC may include some or all of the following:

- Review and provide citizen input on capital project planning and design as it affects bicycling and walking (e.g., corridor plans, street improvement projects, signing or signal projects, and parking facilities).
- Review and comment on changes to zoning, development code, comprehensive plans, and other long-term planning and policy documents.
- Participate in the development, implementation, and evaluation of the Transportation Plan recommendations.
- Provide a formal liaison between local government, staff, and the public.
- Develop and monitor goals and indices related to bicycling and walking in the jurisdiction.
- Promote bicycling and walking, including bicycle and pedestrian safety and education.

Because BPAC members are volunteers, it is essential to have strong staffing supporting the committee in order for it to be successful. A designated city staff member is the logical liaison to the BPAC and should take charge of managing the application process, managing agendas and minutes, scheduling meetings, bringing agency issues to the BPAC, and reporting back to the agency and governing body about the BPAC's recommendations and findings.

ALTERNATE MODES COORDINATOR

The City of Great Falls does not have a designated Alternate Modes Coordinator, though the Planning Department has served some functions. In order for the goals of this plan to be realized, the Alternate Modes Coordinator should be the primary staff person overseeing implementation. In addition, the Alternate Modes Coordinator may have many other duties, including:

- Monitoring the design and construction of bikeways and trails, including those constructed in conjunction with private development projects.
- Ensuring bicycle and pedestrian facilities identified in specific plans are designed appropriately and constructed expediently.
- Serving as the staff liaison to the Bicycle and Pedestrian Advisory Committee.
- Coordinating implementation of the recommended projects and programs listed in this Plan.
- Identifying new projects and programs that would improve the community's environment for bicycling and walking.
- Coordinating evaluation of projects and programs.
- Pursuing external funding sources for project and program implementation.
- Updating the City website and other information portals with bicycling, walking, and trail resources.
- Completing the Bicycle-Friendly Communities application to the League of American Bicyclists.

It is recommended that the City of Great Falls provide dedicated funding for this important position.

BICYCLE PARKING

Adequate bicycle parking is an important component of the bicycle network and represents end-of-trip accommodation for those who choose to travel by bicycle. The recommendations for bicycle parking are separated into several categories, including recommended ordinance and code language, parking design, short- and long-term parking, how bicycle parking may differ depending on land uses and neighborhoods of Great Falls, and how more bicycle parking can be implemented when it doesn't fall into previously outlined categories.

There are no current requirements for providing bicycle parking with new development in Great Falls. The incentive to provide bicycle parking is that it may substitute for a vehicular parking space up to a maximum of 5 percent of the required number of parking space, or 10 spaces, whichever is less (17.36.3.010). Because bicycle parking is not required, it may not be considered for a variety of reasons.

Without a mandatory bicycle parking requirement, existing and potential bicyclists in Great Falls cannot depend on secure, dedicated parking spaces at their destinations. Bicycle parking and end-of-trip facilities can be a determining factor in whether someone decides to make a bicycling trip.

Short-term Bicycle Parking

Short-term bicycle parking is intended for shoppers, customers, and other visitors who require bicycle storage and security for up to several hours. Short-term bicycle parking should serve at least the main entrance of a building and should be visible to pedestrians and bicyclists. Acceptable racks enable the bicyclist to lock the frame and one or both wheels with a user-provided U-lock or cable and support a bicycle by its frame in a stable upright position without damage to the bicycle or its finish.

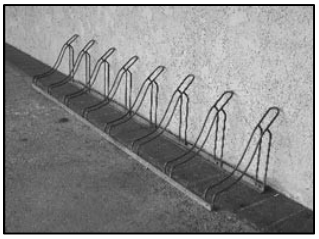
In addition to the existing standards for bicycle parking in the Great Falls Municipal Code in 17.36.3.010-B (which are not included in the recommendations below, but are available in the Existing Conditions section), the City should consider adding the following as bicycle parking area design requirements:

1. If located outside, bicycle parking shall be located within 50 feet of each entrance to the building in a visible and obvious location to bicyclists. Bicycle parking should be permanently secured to a paved surface and be located such that it will not become buried by snow removal operations. Covered bicycle parking is recommended wherever possible.
2. Bicycle parking may be provided within a building, but the location must be easily accessible.
3. Bicycle racks and the area required for parking and maneuvering must meet the following standards:
   a. In covered situations the overhead clearance must be at least 7 feet.
   b. Each required bicycle parking space must be accessible without moving another bicycle.
   c. Areas set aside for bicycle parking must be clearly marked and reserved for bicycle parking only.
   d. At the same grade as the sidewalk or at a location that can be reached by an accessible route

Rack Design

Rack design standards ensure that required bicycle racks are designed so that bicycles may be securely locked to them without undue inconvenience and will be reasonably safeguarded from accidental damage. In addition to the requirements outlined already in the Great Falls Municipal Code, bicycle racks must hold bicycles securely and meet the following criteria:







- Allow the frame and one wheel to be locked to the rack when both wheels are left on the bike
- Allow the frame and both wheels to be locked to the rack if the front wheel is removed
- Be usable by bikes with no kickstand
- Be usable by bikes with water bottle cages





Recommended Bike Racks

Recommended Racks

The following is based on guidance published by the Association of Pedestrian and Bicycle Professionals (APBP).

'Inverted U', or 'Staple' racks are typically secure to a concrete base and are very secure and easy to use.

'Coat Hanger' racks, if used properly, can support a bicycle at two points and can operate fixed to a concrete base or can be moved where needed.



Discouraged Bike Racks

'Post and Loop' or 'Lollypop' racks have many of the same characteristics as 'Inverted U' racks, but are more compact. They can be installed in series (shown) or along a curb line in the sidewalk furnishing zone.

Discouraged Racks

'Wheelbender' racks only support the wheel of the bicycle and can cause serious damage to the bicycle if twisted while secured in the rack. These racks also do not work with all types of locks.

'Comb' racks suffer from many of the same shortcomings as 'Wheelbender' type racks where only the front or rear wheel of the bicycle is supported. Many users of this rack type lift their bicycle over the top and rest the frame on the rack to allow use of a bicycle lock.

'Wave' racks require the cyclist to place their bicycle through the 'wave' pattern, where it is only supported at one point, in order to properly secure the bicycle. Bicycle parked in these racks are unstable and frequently tip over. Many cyclists park their bicycle sideways in this rack to gain stability, thereby reducing the capacity by 60-80 percent.

Bike Corrals (In-street Bicycle Parking)

This type of bicycle parking offers greater quantities of short-term bicycle parking (that would normally be placed on the sidewalk) in a consolidated space on the street occupying a traditional motor vehicle parking space. Bike corrals are commonly installed at locations that attract a high number of bicyclists and where parking bicycles at traditional short-term racks may crowd available sidewalk space. This approach is rapidly gaining popularity in the United States and in Montana (Missoula and Bozeman, pictured).



Example bike corral in Missoula, MT.

Before installing bike corrals, the responsible agency should determine how they will fit into snow removal and storage plans and street sweeping programs. The City may also delegate the installation and/or the maintenance of bike corrals to the BID or similar local, district-based associations.

The bike corral parking area can be delineated or protected using poured concrete curbs, bollards, or planter boxes. Whichever type of delineation is chosen, corrals should be designed with the user in mind, allowing for ingress to and egress from the parking area and maintaining the same aisle and spacing standards desired for the short-term bicycle parking.



Example bike corral in Bozeman, MT.

The benefits of bike corrals are not limited to the users themselves. Corrals can also provide, on average, a ratio of 8 to 12 customers to one parking space, and can focus more customers in targeted areas of downtowns or nearby businesses that tend to attract bicyclists.

Long-term Parking

Long-term bicycle facilities are intended for bicyclists who need to park a bicycle for extended periods during the day, overnight or for a longer duration. Long-term bicycle storage is typically designed for and used by employees, students, residents, and commuters. The facility also frequently protects the bicycle from inclement weather.



Example on-site parking in Seattle, WA.

These facilities may include:

1. **Lockers:** Fully enclosed, secure, and burglar-proof bicycle parking space accessible only to the owner or operator of the bicycle.
2. **Restricted Access Parking:** A location that provides short-term-style bicycle racks within a locked room or locked enclosure accessible only to the owners of bicycles parked within.

3. **Personal Storage:** Storage within the view of the bicycle owner either in his or her office or another secure location within the building.

Facilities that support the above types of long-term bicycle parking include additional end-of-trip facilities like showers and changing areas. It is recommended that the City of Great Falls create a long-term bicycle parking section of the bicycle parking ordinance that provides requirements for new or remodeled buildings, including minimum space standards that should be included in the design and engineering of the building. If a new or remodeled building does not meet the required long-term parking space requirements below, it shall be exempt from this section of the ordinance. An example of ordinance language for long term parking in new and renovated buildings is found in the San Francisco Planning Code, Sections 155.3 and 155.4 (see http://sfgov.org/planning/index.htm).

Downtown Great Falls Bicycle Parking Recommendations

Downtowns are a focal point for bicycle activity due to the high density of employment, restaurants and services. Downtowns are often under supplied in available motor vehicle parking, with many visitors unable to find parking in the immediate vicinity of their destination. Riding a bicycle downtown can offer many advantages to driving, including the ability to park a bicycle at the visitor's intended destination, and as a way to avoid parking fees at meters or in garages. Great Falls' downtown has a few bicycle racks, but there is not a dedicated program to ensure that these prime destinations have adequate accommodations for bicyclists. The 'Inverted U' or 'Post and Loop' rack type located parallel to the curb line in the sidewalk furnishing zone along with bicycle corrals at key locations are recommended.

Request-A-Rack

The City or the Downtown Association should maintain a supply of bicycle racks that can be installed at the request of an existing business owner such a supply will increase the supply of bicycle parking downtown and provide strategic expansion for bicycle parking and to mitigate bicycles locked to posts, signs, and trees.

Minimum Required Bicycle Parking Spaces Ordinance

It is proposed that the following be incorporated into City codes and ordinances (17.36.3.010). Cascade County should also incorporate the same bicycle parking requirements as stated below into existing zoning districts where commercial uses are permitted. Additionally, Cascade County should incorporate bicycle parking requirements into any proposed zoning districts or County-wide zoning efforts for commercial areas. Only those bicycle parking requirements pertaining to allowed uses for each zoning district should be included for that district.

Currently, the Great Falls Municipal Code lists land uses and number of bicycle parking spaces as recommended, with the language, "Bicycle parking *may* be provided consistent with the *recommended* standards contained in [this]…exhibit." The following land use categories and uses, as well as the short- and long-term bicycle parking spaces should be *required*. This ensures that bicyclists will be able to have predictable parking at their destinations.

At minimum, the number of spaces shown in **Table 7** should be considered.

Table 7: Recommended Minimum Required Bicycle Parking Spaces by Land Use

Use Categories	Specific Uses	Long-term spaces	Short-term spaces
Residential Categories			
Household Living	Multi-dwelling	1 per 4 units; or if no garage is available, 1 per unit	2, or 1 per 20 units
Group Living		2, or 1 per 20 residents	2, or 1 per 20 units
	Dormitory	1 per 8 residents	2, or 1 per 20 units
Commercial Categories			
Retail Sales and Service		2, or 1 per 12,000 sq. ft. of net building area	2, or 1 per 5,000 sq. ft. of net building area
	Temporary Lodging	2, or 1 per 20 rentable rooms	2, or 1 per 20 rentable rooms
Office		2, or 1 per 10,000 sq. ft. of net building area	2, or 1 per 40,000 sq. ft. of net building area
Commercial Parking		10, or 1 per 20 auto spaces	None
Commercial Outdoor Recreation		10, or 1 per 20 auto spaces	None
Major Event Entertainment		10, or 1 per 40 seats	2, or 1 per 40,000 sq. ft. of net building area
Industrial Categories			
Manufacturing and Production		2, or 1 per 15,000 sq. ft. of net building area	1 per 5,000 sq. ft. of floor space
Warehouse and Freight Movement		2, or 1 per 40,000 sq. ft. of net building area	1 per 20,000 sq. ft. of floor space
Institutional Categories			
Basic Utilities	Transit stations	8	None
Community Service		2, or 1 per 10,000 sq. ft. of net building area	2, or 1 per 10,000 sq. ft. of net building area
	Park and Ride	10, or 5 per acre	None
Parks and Open Areas		Per review	Per review
Schools	Elementary and/or Junior High	2 per classroom, or 1 per 5 students	2 near administrative offices
	Senior High or similar school	4 per classroom, or 1 per 10 students	2 near administrative offices
Colleges	Excluding dormitories (see Group Living, above)	2, or 1 per 20,000 sq. ft. of net building area, or per review	2, or 1 per 10,000 sq. ft. of net building area, or per review
Medical Centers		2, or 1 per 70,000 sq. ft. of net building area, or per review	2, or 1 per 40,000 sq. ft. of net building area, or per review
Religious Institutions		2, or 1 per 4,000 sq. ft. of net building area	2, or 1 per 2,000 sq. ft. of net building area
Daycare		2, or 1 per 10,000 sq. ft. of net building area	None
Other Categories			
Aviation and Surface Passenger Terminals, Detention Facilities		5 per terminal	None

Note: Wherever this table indicates two numerical standards, such as "2, or 1 per 3,000 sq. ft. of net building area," the larger number applies.

EDUCATION AND ENCOURAGEMENT PROGRAM RECOMMENDATIONS

The following programs are designed to raise awareness of walking and bicycling; connecting users to existing and proposed resources; educating these users; and encouraging residents and visitors in the Great Falls area to walk and ride a bicycle more often. Many of the recommended programs can be administered or implemented by volunteer groups or non-profit organizations.

Bicycling Map

Target: All bicyclists or potential bicyclists who are interested in knowing how and where to ride a bicycle.

Coordinating Agency and Partners: City of Great Falls, Recreational Trails, Inc., Great Falls Bicycle Club, Chamber of Commerce, Cascade County.

Key Elements: Clear symbology, designations, and services attractive for bicyclists. Use the map as a visual representation of bicycle infrastructure in the area and guide bicyclists, potential bicyclists, and visitors to designated bicycling routes, lanes, trails, paths, and related amenities. Update it regularly.

Time frame: When coordinating agency and partners feel that the on- and off-street infrastructure network has developed to the point that it can and should be mapped; on-going.

Potential funding sources: City of Great Falls; bike shops (in-kind donation); printers; active wellness, hospitals, and insurance companies; other sources of advertising; other revenue-generating sources to offset cost of printing and distribution.

Sample programs: Salt Lake City: http://bikeslc.com/WheretoRide/PDF/SLC2013BikeMapWebsite.pdf

One of the most effective ways of encouraging people to bike is through the use of visual information on maps to show where existing or proposed infrastructure is located, communicate the ease of bicycling in Great Falls, and highlight recreational areas, popular destinations, and the area's trails system. The existing River's Edge Trail map, which is displayed and available for free at trail kiosks and in bike shops, provides excellent paved and unpaved trail information for the area. As the on-street bicycling network expands, a print and web version of an area-wide Great Falls bicycle map of on- and off-street bicycle facilities should be created not only to guide users and potential users, but also to provide a visual progress report from edition to edition. Maps should be available from the Chamber of Commerce, City Hall, bike shops, area hotels, and in kiosks along the River's Edge Trail.

Recreation and Bicycle Tourism

Target: Recreational and touring bicyclists; out-of-town bicyclists

Coordinating Agency and Partners: Great Falls Area Chamber of Commerce, City of Great Falls, Cascade County, Great Falls Bicycling Club, Recreational Trails, Inc., Adventure Bicycling Association, Get Fit Great Falls

Key Elements: Create and promote existing and future bicycling attractions and events (i.e. River's Edge Trail and mountain bike trails);

encourage out-of-town bicyclists to visit, stay, recreate, and spend money

Time Frame: On-going

Potential Funding Sources: Chamber of Commerce; hotels associations; mountain biking organizations (local, state, and national); City of Great Falls; bike shops (in-kind donation)

Sample Programs: http://www.adventurecycling.org
http://www.warmshowers.org

Partnering with the Great Falls Area Chamber of Commerce, the Great Falls area can cater to and attract touring and recreational bicyclists. Great Falls has the opportunity to raise its profile as a recreational bicycling destination and as the home to a world class paved and unpaved trail system. A partnership of the City of Great Falls, the Great Falls Chamber of Commerce, Great Falls Bicycle Club, and Recreational Trails, Inc., can plan how to use their meetings, websites, and other promotional tools to market cycling to current and potential visitors. Additional strategies could include launching a branding and signage campaign; promoting routes to, from, and within Great Falls via the Adventure Cycling Association, a national bicycle tourism and recreational route organization; and organizing a signature event in Great Falls capitalizing on its trails and other attractions that would be inviting to bicyclists, spectators, and other users (similar to Helena's mountain biking events).



Bicycle Touring in Libby, MT

Media Campaign

Target: Motorists, bicyclists, and pedestrians

Coordinating Agency and Partners: Great Falls Area Chamber of Commerce, City of Great Falls, Cascade County, Great Falls Police Department, Get Fit Great Falls

Key Elements: Media outreach, enforcement, education through media

Time Frame: On-going, targeted between March and November

Potential Funding Sources: Local print, television, and digital news outlets; billboard companies; traffic safety foundations and grant programs

Sample Programs: Portland's "See & Be Seen" Campaign: http://www.portlandonline.com/transportation/index.cfm?&c=deibb&a=bebfjh
Pittsburgh's "Care" Campaign: http://bikepgh.org/care

People often do not walk or ride a bike because they don't know the rules of the road or where to walk or ride. A marketing campaign that highlights these elements, safety, other support programs, etc., is an important part of creating awareness of bicycling and walking in the Great Falls area. This type of high-profile campaign is an effective way to reach the general public, highlight bicycling and walking as viable forms of transportation, and reinforce safety for all road users. Campaigns are particularly effective when kicked off in conjunction with other bicycling/walking events, back to school in the fall, major community events, baseball games, or other related initiatives.



Tacoma, WA's media campaign.

Youth Bicycle Safety Education

Target: Youth and elementary and secondary school-age students

Coordinating Agency and Partners: Journey from Home Montana, Safe Routes to Schools, Great Falls Public Schools, City of Great Falls

Key Elements: In-school or otherwise student and youth-focused instruction; safety; transportation mode choice

Time Frame: On-going

Potential Funding Sources: Federal and state safety grant funding; grants or other funding sources from the public school district; Department of Education

Sample Programs: http://www.journeysfromhomemontana.org
http://www.saferoutesinfo.org



Journey from Home Montana safety clinic.

The Journeys from Home Montana group (http://www.journeysfromhomemontana.org) provides children and youth with educational opportunities, classes, clinics, and rides to enable them to travel safely and predictably under their own power in their communities. Facilitators and administrators of this program are a multi-generational group of educators, designers, and filmmakers whose aim it is to prevent traffic-related childhood injury. Participating in the classes and services Journeys from Home Montana provides will allow the Great Falls area to benefit from state-wide knowledge and local expertise.

School-based bicycle education programs educate students about the rules of the road, proper use of bicycle equipment, biking skills, street crossing skills, and the benefits of biking. These types of education programs can be part of a Safe Routes to School program (for more information, visit http://www.saferoutesinfo.org), which are usually sponsored by a joint City/school district committee that includes appointed parents, teachers, student representatives, administrators, police, active bicyclists and engineering department staff. The program can be effectively administered by a non-profit or other third-party bicycling, education, or safety-oriented organization.

OTHER BICYCLING AND WALKING RECOMMENDATIONS

Data Collection and User Counts

Target: n/a

Coordinating Agency and Partners: City of Great Falls, Cascade County, Recreational Trails, Inc., Great Falls Bicycle Club, Get Fit Great Falls, PPL Montana

Key Elements: Regular bicycle and pedestrian user counts and surveys at set locations to provide for evaluation over time.

Time Frame: Annually

Potential Funding Sources: General funds, private donations

Sample Programs: National Bicycle & Pedestrian Documentation Project:
http://www.bikepeddocumentation.org
http://www.fhwa.dot.gov/environement/bikeped/study



Bicycle intercept survey and count.

Addressing the lack of existing bicycle and pedestrian count data and beginning data collection will help provide objective, data-driven support for the expansion of a bicycle and pedestrian network. Regularly documenting and assessing actual bicycle/pedestrian activity will help the City of Great Falls and Cascade County target investments where they are most beneficial and measure changes in rates of bicycling and walking over time. Bicycle and pedestrian user counts and surveys can be performed by trained volunteers and can require little, if any, supervision by City staff. In order to determine this Plan's success at increasing bicycling and walking rates, it is necessary to establish an annual data collection program. This program should tally the number of cyclists, pedestrians, and path users at key locations around the community (particularly at pinch points, in downtown, near schools, and on trails/paths); the same locations should be counted in the same manner annually or at standard times of the year to show changes in usage. If major non-motorized infrastructure projects (both public and private) are planned, baseline and post-construction user counts can be performed through this coordinated annual count process for maximum efficiency. Bozeman, Missoula, and Billings have all recently instituted counting programs using both manual volunteer-based counts and also automatic counters using various forms of detection.

A quality data-monitoring program can also help Great Falls obtain funding for new projects. Most grant programs require awardees to monitor the results of funded projects, including a baseline count and usage over time. Cities and counties with established bicycle and pedestrian monitoring programs have an advantage over others when pursuing funding, especially where they are able to suggest a relationship between rising activity levels and new investment(s) over a substantial period of time. Bozeman found in 2005 that adding bicycle lanes and sidewalks during a road retrofit increased bicycling and walking by a combined 258 percent. Subsequent observation over the 2011-2013 period has shown even more dramatic increases in bicycling. Data collection, including the collection of traffic speeds and volumes, crashes, compliance, weather conditions, or other factors (as the City of Great Falls and MDT already do) is also an essential tool for analyzing the success of any project, particularly projects that employ innovative or new treatments. Great progress on area-wide counts has already made through

some unique partnerships. For example, PPL Montana funding has allowed Pinnacle Research to collect user count data on the Rivers Edge Trail (RET) since 2007. The resulting data has been used for a variety of purposes. Most recently, the PPL Montana funded count information on RET has been used to bolster several grant applications for improvements to the RET.

It is recommended that the data collection program use methodology developed by the National Bicycle and Pedestrian Documentation project (http://www.bikepeddocumentation.org). In order to capitalize on moderate climate conditions, counts should be performed in the second week in September; one weekday count (from 5-7 PM on a Tuesday, Wednesday, or Thursday) and one Saturday count (12-2 PM) should be completed. Counters can be volunteers or agency staff, as long as proper training is provided. Procedures, answers to frequently asked question, forms, example, and more information in general are found on the website listed above.

By establishing and dedicating staff resources to a formal count program or initiative, Great Falls can begin to document progress on increasing walking and biking rates via a 'Report Card' and build community support and awareness for future projects.

Benchmarking Report

Target:	n/a
Coordinating Agency and Partners:	City of Great Falls, Cascade County, MDT
Key Elements:	Regular examination of key metrics to track trends in bicycling and walking over time.
Time Frame:	Annually or biannually
Potential Funding Sources:	General funds or grant funding for initial report, staff time to update at regular intervals
Sample Programs:	Minneapolis Bicycle Account: http://www.ci.minneapolis.mn.us/www/groups/public/@publicworks/documents/images/wcms1p-085029.pdf

A benchmarking report will be able to help guide the City of Great Falls as it moves towards improving conditions for non-motorized users by tracking and visualizing past investments and future investments at regular intervals. The document will be created in its first edition to establish baselines in non-motorized user counts, miles of facilities developed over time, crashes and other metrics that can be updated by the city on a regular basis. Such a document is helpful to maintain steady investment over time and to track the benefits of those investments.

5.3.3. Recommended Facilities

Bicycle facilities vary from bicycle routes designated by signage or shared lane markings to separated, off-street facilities along exclusive rights-of-way. Opportunities to develop bicycle facilities and a cohesive network also vary and may range from deliberate and coordinated development on the part of the city to taking advantage of independent street construction, reconstruction and resurfacing projects. Street re-surfacing in particular, is a low-cost way to provide bicycle infrastructure. When streets are resurfaced, new pavement markings are required. During this process, bicycle facilities can often be added depending on existing roadway width and feasibility.

The recommended Great Falls area bike network represents a comprehensive set of existing and proposed bicycle transportation and recreation facilities. Bicycle network improvements are depicted graphically in **Figure 3**. The proposed bicycling network for the Great Falls area consists of:

- Shared lane markings
- Bike lanes
- Buffered bike lanes
- Shared use path projects and connections to trails and paths
- Spot improvements including signalization, crossings, tunnels, traffic diverters, etc.

In the case of roadway retrofit projects where a street may be reconfigured to provide the physical space for bicycle or buffered bicycle lanes additional study, neighborhood outreach, business outreach and other activities may be needed prior to implementation.

Shared Lane Markings

Shared lane markings, or sharrows, are stenciled markings installed as an on-street facility where bicycles share the travel lanes with automobiles. Typically, these facilities occur on local roadways or on roadways with low traffic volumes and speeds. Streets with low motor vehicle volumes and speeds that are prioritized for bicycle travel are known as 'Bicycle Boulevards'. Such streets ideally have speeds of less than 25 mph and volumes of less than 3,000 vehicles per day. Treatments could include reconfiguring or providing stop signs to favor bicyclists, pavement markings, wayfinding signage, and intersection treatments. The level of treatment varies between facilities and is dictated by traffic conditions and safety. Traffic calming should only be applied to bicycle boulevards where traffic speeds or volumes are deemed excessive, or where the neighborhood supports or requests such treatments. **Table 8** depicts recommended segments of the major street network for consideration of shared lane markings.

Table 8: Recommended Shared Lane Markings

ID	Location	Length (miles)	Notes	Estimated Cost
SLM-1	**9th Ave S** *47th St S to 54th St S*	0.49	Shared lane markings as alternative to 10th Avenue South; replaces Bike-4 from 2009 LRTP Update which recommends 8th Ave.	$7,100
SLM-2	**9th Ave S** *29th St S to Ella Dr*	1.26	Alternative to 10th Avenue South; replaces Bike-4 from 2009 LRTP Update which recommends 8th Ave.	$18,200
SLM-3	**9th Ave S** *2nd St S to 27th St S*	2.03	Alternative to 10th Avenue South; replaces Bike-4 from 2009 LRTP Update which recommends 8th Ave.	$29,300
SLM-4	**13th Ave S** *River's Edge Trail to 20th St S*	1.55	East-west route south of 10th Avenue South; part of Bike-13 recommendation from 2009 LRTP Update.	$22,200
SLM-5	**University of Great Falls West** *20th St S to Administration Complex*	0.09	Shared lane markings.	$1,400
SLM-6	**University of Great Falls East** *Providence Hall to 23rd St S*	0.08	Shared lane markings.	$1,300
SLM-7	**12th Ave S** *23rd St S to 26th St S*	0.24	Shared lane markings.	$3,700
SLM-8	**17th Ave NE** *River's Edge Trail to 17th Ave NE*	0.04	Connection to River's Edge Trail for NW neighborhoods; part of Bike-2 Recommendation from 2009 LRTP Update.	$700
SLM-9	**20th St** *9th Ave S to 8th Ave N*	0.88	Possible bike boulevard (traffic diversions already exist).	$12,700
SLM-10	**36th St** *10th Ave S to 38th St N*	1.16	Bicycle boulevard on a quieter street, will need wayfinding on the north side of the route to reach the shared use path; Bike - 3 recommendation from 2009 LRTP Update.	$16,700

ID	Location	Length (miles)	Notes	Estimated Cost
SLM-11	**2nd St** *2nd Ave S to 4th Ave N*	0.3	Shared lane markings on 2nd Street South from recommended bike lanes at 2nd Avenue South to Riverfront Park. Turn lanes and parking suggest bike lanes may not be realistic for this segment. Parking on one side, or the center turn lanes could be removed, to provide a continuous bike lane at least up to 2nd Avenue North.	$4,400
SLM-12	**4th Ave N** *38th St N to 52nd St N*	0.96	Partially from the Bike-6 recommendation in the 2009 LRTP Update, but instead of terminating at 46th Street South, the route is continuous to 52nd Street North, connecting to many additional trails.	$13,900
SLM-13	**46th St** *Ella Dr to 4th Ave N*	0.7	Bike route connecting 4th Avenue North to 9th Avenue South. Partially from the Bike-6 recommendation in the 2009 LRTP Update, but instead of terminating at 3rd Avenue South, the route continuous to 9th Avenue South.	$10,100
SLM-14	**Park Garden Rd** *14th St SW to Park Garden Estate*	0.81	New bike route; partial fulfillment of Bike-10 recommendation in the 2009 LRTP Update.	$11,800
SLM-15	**13th Ave SW** *14th St SW to 11th St SW*	0.36	Bike route	$5,200
SLM-16	**14th St SW** *Park Garden Rd to 13th Ave SW*	0.51	Connects Park Garden Road to 13th Avenue SW. Option exists to remove a northbound travel lane, south of Country Club Blvd, and re-stripe road to have bike lanes in both directions. Turn lanes to I-15 interchange can be rebuilt. This bike route was proposed as part of the Bike-14 recommendation in the 2009 LRTP Update. The trail along the BNSF line will provide a more comfortable connection to the mall than designating this arterial as a bike route.	$7,500
SLM-17	**18th Ave SW** *BNSF Rail Trail to Fox Farm Rd*	0.36	If trail along BNSF railroad is completed.	$5,200
SLM-18	**6th St NW** *Smelter Ave NE to 36th Ave NE*	0.65	Install only if 38th Avenue NE connects through. This is part of the Bike-15 recommendation in the 2009 LRTP Update. This will likely not be a very comfortable route due to gradient and the narrowness of the unimproved road. If the road is ever reconstructed, consider bike lanes, or at least an uphill bike lane.	$9,500
SLM-19	**Park Garden Rd** *Gore Hill Connector to 14th St SW*	0.54	This part of the connection does not tie into the eastern section of Park Garden Road and would have marginal value without the shared-use path at Gore Hill. If the Gore Hill shared-use path is completed, this street should have sharrows added to aid wayfinding. This is part of the Bike-10 recommendation in the 2009 LRTP Update.	$7,800
SLM-20	**36th Ave NE** *6th St NW to Bootlegger Trail*	2.46	Road is 44 feet wide and could support bike lanes, but due to the character of the street, shared lane markings are recommended. If 36th Avenue NE ever extends to 6th Street NW, the sharrows should be added when constructed. This is part of the Bike-15 and Bike -19 recommendations in the 2009 LRTP Update.	$35,400
SLM-21	**17th & 19th Ave S** *Upper River Rd to Overlook Dr*	0.53	Part of Bike-17 recommendation in the 2009 LRTP Update.	$7,700
SLM-22	**4th Ave S** *3rd St S to 3rd Ave S / 43rd St S*	3.29	Traffic volumes range from 400-900 vpd - should be a successful bike route. High School provides barrier in vehicular flows.	$47,300
SLM-23	**17th Ave S** *13th St S to 20th St S*	0.54	Connecting bike lanes at each end and Sunnyside Elementary School.	$7,900
SLM-24	**6th St N** *8th Ave N to River Rd N*	0.1	Shared lane markings.	$1,500
SLM-25	**2nd Ave S** *15th St S to 38th St S*	1.88	Continues from buffered bike lane couplet.	$26,900

ID	Location	Length (miles)	Notes	Estimated Cost
SLM-26	**Black Eagle Connector** *15th St N to 20th St N*	0.28	Much of this is unpaved, so wayfinding signage is important. The intent is to make Black Eagle more aware of good connections to the River's Edge Trail.	$4,100
SLM-27	**19th St N** *Black Eagle Connector to 25th Ave N*	0.19	North / south spine bike route for Black Eagle. Leads to the River's Edge Trail. Wayfinding signs are important.	$2,900
SLM-28	**6th St & 9th St NE** *Smelter Ave NE to 36th Ave NE*	0.98	This bike route has changed slightly from the 2009 LRTP Update to incorporate access to the school on Sacajawea Dr.	$14,100
SLM-29	**Division Rd / Riverview 4 / 2nd St NE** *Smelter Ave NE to 40th Ave NE*	0.95	This is modified from the 2009 LRTP Update which calls for the bike route to continue up Division Road and terminate at Riverview Drive. There is considerable growth in this area and modifying the bike route to utilize 2nd Street NE will create more connectivity.	$13,700
SLM-30	**3rd Ave S** *43rd St S to 57th St S*	0.84	This recommendation differs from the 2009 LRTP Update in that it terminates at 57th Street South (future bike lanes), and also at 43rd Street South, to connect with the 4th Avenue South bike route that goes all the way downtown.	$12,200
SLM-31	**Cherry Drive / Meadowlark Dr** *Fox Farm Rd to Meadowlark Dr Connector*	0.46	From the 2009 LRTP Update. Only makes sense to implement if the Country Club connection can be made at the east end of Meadowlark Drive.	$6,700
SLM-32	**32nd St** *Charles Russell Park Trail to 8th Ave N*	1.26	From the 2009 LRTP Update, with modification at south end to connect with medical center and future trail	$18,200
SLM-33	**8th Ave N** *6th St N to 38th St N*	2.62	Street is already signed as a bike route, shared lane markings would help emphasize bicycle presence, particularly westbound where downhill grades may influence high speeds.	$37,600
SLM-34	**4th Ave N** *2nd St N to 38th St N*	2.93	Street is already signed as a bike route; shared lane markings would help emphasize bicycle presence.	$42,100
SLM-35	**12th Ave N / 19th St N** *15th St NE to River Dr N*	0.39	Low volume road used by bicyclists to access River's Edge Trail, shared lane markings would help emphasize bicycle presence.	$5,700
SLM-36	**5th Ave SW** *4th St SW to 6th St SW*	0.15	Add shared lane markings, per MPO request.	$2,300

TOTAL SHARED LANE MARKING PROJECTS: **$475,000**

Bike Lanes

A bike lane provides a striped and stenciled lane for one-way travel on a street or highway. Many of the identified projects will be completed by the City of Great Falls, Cascade County, or MDT through retrofit or as part of maintenance activities (striping and signage only).

Similar to a bike lane in that a striped and stenciled lane is provided for one-way bicycle travel on a street or highway, buffered bicycle lanes provide additional width to 'buffer' the bike lane, on the side of the adjacent travel lane and/or parking lane. They provide a more comfortable experience for bicyclists, but they also are an effective tool to discourage motorists from driving or parking in the bike lane that would otherwise be excessively wide. This excessive width can sometimes be present when a roadway reconfiguration project converts an underutilized travel lane or parking lane to a bike lane.

Table 8 contains segments on the major street network that are recommended for bike lanes or buffered bike lanes. The type of project that is ultimately chosen is at the discretion of the planning staff.

Table 9: Recommended Bike Lanes

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-1	**4th St S** *10th Ave S to 17th Ave S*	0.31	Identified as a bike route in the 2009 LRTP Update. Street is approximately 38 feet wide, with surface parking lots along the street. Recommend 6 foot bike lanes be added. No striping changes needed otherwise.	$3,500
BIKE-2	**11th Ave S** *26th St S to 32nd St S*	0.5	Typical section options include 12-foot travel lanes and 5-foot bike lanes, or 11-foot travel lanes and 6-foot bike lanes. ADT is 4,750 vpd (in 2011 per MDT). Curb-to-curb width is 34 feet.	$5,700
BIKE-3	**11th Ave S** *32nd St S to 39th St S*	0.56	Adapted from Bike-7 in 2009 LRTP Update. Road exhibits 44-45 feet of curb-to curb width. No traffic counts are available. Typical section options include: Option 1: 10-foot travel lanes, 5-foot bike lanes and 7.5-foot parking lanes. Option 2: 12-foot travel lanes, 6-foot bike lanes 8-foot parking lane. Parking would be eliminated on one side of street. Recommend eliminating parking on south side due to land use and availability of off-street parking. Option 3: Provide shared lane markings 13 feet from curb face.	$5,800
BIKE-4	**2nd Ave N** *38th St N to 57th St N*	1.22	Pavement symbols and signs needed only.	$8,800
BIKE-5	**20th St S** *10th Ave S to 17th Ave S*	0.34	Just south of 10th Avenue South, ADT is 7,790 vpd (in 2011 per MDT). Curb-to-curb width is 34 feet. Typical section options include 12-foot travel lanes and 5-foot bike lanes, or 11-foot travel lanes and 6-foot bike lanes.	$4,000
BIKE-6	**16th Ave S** *20th St S to 23rd St S*	0.24	ADT is 3,720 vpd (in 2011 per MDT). Curb-to-curb width is 34 feet. Typical section options include 12-foot travel lanes and 5-foot bike lanes, or 11-foot travel lanes and 6-foot bike lanes.	$2,900
BIKE-7	**23rd St S** *10th Ave S to South of Hospital Trail*	0.33	ADT is 4,410 vpd (in 2011 per MDT). Curb-to-curb width is 34 feet. Typical section options include 12-foot travel lanes and 5-foot bike lanes, or 11-foot travel lanes and 6-foot bike lanes.	$3,800
BIKE-8	**26th St S** *11th Ave S to 24th Ave S*	0.63	ADT is 12,380 vpd just south of 10th Avenue South. No turn bay configuration changes would be proposed. ADT is 3,850 vpd just north of 24th Avenue South and 1,560 vpd just south of 24th Avenue South (in 2011 per MDT). 4- to 3-lane conversions have been successful on streets with as high as 23,000 vpd. 20,000 vpd is the generally accepted rule of thumb in the industry. Proposed changes include providing TWLTL and bike lanes. The curb-to-curb width is 50 feet, which would allow for 6-foot bike lanes, 12-foot travel lanes and a 12-foot TWLTL.	$58,800
BIKE-9	**13th St S** *10th Ave S to 24th Ave S*	0.53	Road is already striped with a white line and sufficient shoulder in most places. ADT is 7,530 vpd just south of 10th Avenue South, 4,950 vpd just south of 22nd Avenue South and 3,270 vpd just south of 24th Avenue South. When this is restriped, areas with three lanes (turn lane) may need to be narrowed up slightly to provide bicycle access.	$20,800
BIKE-10	**24th Ave S** *13th St S to Eastern Terminus*	1.51	Future project if road is reconstructed or widened. Part of Bike-11 recommendation in the 2009 LRTP Update.	$17,200

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-11	**Fox Farm Road** Cherry Dr to E Fiesta	0.74	Road width is 50 feet (curb-to curb). ADT is 6,880 vpd (in 2011) just north of Park Garden Road and has generally been declining since 2007 (MDT). ADT reduces to 5,290 vpd south of Park Garden Road and 2,760 vpd near E Fiesta. Bike lanes can be added while maintaining existing parallel parking, 8.5-foot parking lanes, 5-foot bike lanes, and 12-foot travel lanes. As a second option, parking could be eliminated on the east side of the street where all houses on this section have either existing side street parking or are not oriented to Fox Farm Road. In this option the road would have an 8-foot parking lane on the west, a 2-foot buffer, a 5-foot parking lane, two 12-foot travel lanes, a 10-foot center turn lane (TWLTL) and a 5-foot bike lane.	$7,600
BIKE-12	**20th St S** *10th Ave S to 9th Ave S*	0.05	Short section of bike lane to provide continuity with bike lane on south side off 10th Avenue South. Prohibit parking - ample parking exists along this street off-street.	$600
BIKE-13	**38th St** *10th Ave S to River Dr N*	1.24	For northern portion (10th Avenue North to River Drive North) pavement width is about 27 feet and would need to be widened at some point in the future during a resurfacing or reconstruction project. For southern portion the road is currently 34 feet in width, making each side of the road about 17 feet - which is not a comfortable dimension for on-street parking. Suggest 11-foot driving lanes and 6-foot bike lanes all the way to 10th Avenue South. This was previously recommended in the 2009 LRTP Update.	$14,100
BIKE-14	**2nd St S** *10th Ave S to 2nd Ave S*	0.45	This project replaces the Bike-5 recommendation from the 2009 LRTP Update, which recommended a bike route be established. The street is approximately 47 feet wide which would translate to two options. Option 1: 8-foot parking lanes, 5-foot bike lanes, and 10.5-foot travel lanes, or Option 2: 7.5-foot parking lanes, 5-foot bike lanes, and 11-foot travel lanes. At the extreme south end, suggest ramping southbound bike lane up on to sidewalk and either connecting to trail along north side of 10th Avenue South, or crossing users to the NE corner to connect with the Overlook Drive Path.	$4,700
BIKE-15	**57th St S** *10th Ave S to 2nd Ave N*	0.65	All that is needed is to paint the symbols and sign the route. Consider adding a through bike lane at 2nd Avenue North and a bike slip lane going east to Malmstrom AFB.	$4,800
BIKE-16	**10th Ave N** *38th St N to 10th Ave N AFB Gate*	1.38	Provide bike lanes if and when road is reconstructed. For approach to Malmstrom AFB, two eastbound lanes currently exist, though these constrict to one in a chicane near the guarded entry point. Consider restriping road to provide bike lanes, and a link for residents on base, to the rest of the Great Falls bicycle system.	$15,700
BIKE-17	**Central Ave W** *Sun River Trail to I-15*	1.08	If road is ever improved or widened, 4-foot shoulders would suffice. Part of Bike-12 recommendation in the 2009 LRTP Update.	$12,300
BIKE-18	**Central Ave W** *I-15 to 3rd St NW*	1.39	Consider prohibiting on-street parking and providing bike lane symbols and signs west of 9th Street NW. East of 9th Street NW the travel lanes would need to be resized to 10-foot travel lanes to provide 5-foot bike lanes. Road is currently between 60 and 62 feet curb-to-curb. Consider exploring the idea of a road diet which would result in a 3/lane cross-section (which have been shown to handle ADTs in excess of 20,000 vehicles per day). Buffered bike lanes could be created to the railroad crossing if the road were reduced to 3 lanes.	$10,000

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-19	**6th St NW** *NW Bypass to Smelter Ave NW*	0.39	This street is too narrow to provide bicycle lanes and parking. Parking appears to be underutilized. Road appears to have been re-built in recent years with new sidewalks and curb and gutter. Options are to prohibit parking completely, providing for 9-foot bike lanes (no change to the existing striping would be required other than adding pavement markings and signage), or to prohibit parking on one side of the street, relocate the centerline and provide 5-foot bike lanes in both directions. In this second option the street would have one 8-foot parking lane, 5-foot bike lanes and two 12-foot travel lanes.	$2,900
BIKE-20	**17th Ave S** *4th St S to 13th St S*	0.75	Bike lanes can be striped along this entire stretch with no changes to configuration. This route connects several major destinations. No on-street parking is currently available except for one stretch where the street has been widened. This project differs from the bike route that was proposed in the Bike 17 recommendation in the 2009 LRTP Update.	$8,500
BIKE-21	**25th St N** *8th Ave N to N River Rd*	0.15	Street is 34 feet wide. Prohibit parking (all businesses have large off-street lots) and provide 5-foot bike lanes. Unless a connection to the River's Edge Trail can be made, there is little point to this project.	$1,700
BIKE-22	**15th St N** *Wire Mill Rd to Bootlegger Trail*	0.49	Add bicycle pavement markings and signs to existing shoulder of 15th Street North, from Montana Avenue to 36th Avenue NE. This project replaces the Bike 19 Recommendation in the 2009 LRTP Update, which recommends bike route signage only. This project also does not connect directly to the River's Edge trail as adequate width does not exist in the street south of Montana Avenue where the road is constrained. Speeds are too high for a shared lane.	$3,500
BIKE-23	**9th St N** *2nd Ave N to 8th Ave N*	0.31	Sharrow pavement markings are installed on this segment. Street is 46 feet wide. Bike lanes were recommended on 9th Street in the past two versions of the LRTP. Option 1: Narrow parking and travel lanes. Arrive at a section that includes 7.5-foot parking lanes, 5-foot bike lanes and 10.5-foot travel lanes. Option 2: Most residences/businesses have parking off of east-west cross streets. Remove one parking lane to provide a cross section of an 8-foot parking lane, 2-foot buffer, 5-foot bike lane, 12-foot travel lanes, 2-foot buffer, and a 5-foot bike lane. Removing parking would have to be by action of the City Commission and is highly unlikely.	$5,200
BIKE-24	**9th St N** *1st Ave N to 2nd Ave N*	0.05	Sharrow pavement markings have been installed on other segments of this corridor. Street is 42 feet wide curb-to-curb. Reduce travel lanes to 10.67 feet in width, and provide 5-foot bike lanes.	$1,900
BIKE-25	**9th St N** *Central Ave to 1st Ave N*	0.05	Sharrow pavement markings have been installed on other segments of this corridor. Remove southbound right turn bay, convert through lane to a combination lane and provide bike lanes. From 2013 RPA TMC's, right turns account for 15% of AM Peak and less than 11% of PM Peak. Because through bicyclists will be to the right of some turning traffic, intersection markings and "yield to bikes" signs should be added at this intersection.	$1,900
BIKE-26	**9th St S** *1st Ave S to Central Ave*	0.05	Sharrow pavement markings have been installed on other segments of this corridor. Remove northbound right turn bay. According to 2013 RPA TMC's, AM Peak hour shows 6% of northbound traffic turning right at Central, whereas PM Peak hour shows 8% of northbound traffic turning right. Eliminating this turn lane will have a very minor impact on traffic. Space can be used to provide bike lanes in both directions. Intersection alignments may be slightly off, but not greatly so.	$1,900
BIKE-27	**9th St S** *2nd Ave S to 1st Ave S*	0.05	Sharrow pavement markings have been installed on other segments of this corridor. Street is 42 feet wide curb-to-curb. Reduce travel lanes to 10.67 feet in width, and provide 5-foot bike lanes.	$1,900

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-28	**9th St S** *10th Ave S to 2nd Ave S*	0.41	Sharrow pavement markings have been installed on other segments of this corridor. Street section varies as 44-to-46 feet (changes block by block). Bike lanes were recommended on 9th Street in the past two versions of the LRTP. Option 1: Where 46 feet wide - narrow parking and travel lanes. Arrive at a section that includes 7.5- foot parking lanes, 5-foot bike lanes and 10.5-foot travel lanes. Where 44 feet wide: 7-foot parking lanes, 5-foot bike lanes and 10-foot travel lanes. Option 2: Most residences/businesses have parking off of east-west cross streets. Remove one parking lane to provide a cross section of an 8-foot parking lane, 2-foot buffer, 5-foot bike lane, 12-foot travel lanes, 2-foot buffer, and a 5-foot bike lane. Removing parking would have to be by action of the City Commission and is highly unlikely.	$4,200
BIKE-29	**9th St S** *17th Ave S to 10th Ave S*	0.31	Sharrow pavement markings have been installed on other segments of this corridor. Section is approximately 34 feet. Street is continuously served by off-street parking lots. Provide 6-foot bike lanes and 11-foot travel lanes. Prohibit parking along entire length. Prohibiting parking would have to be by action of the City Commission and is highly unlikely.	$8,000
BIKE-30	**Smelter Ave NW** *6th St NW to 5th St NE*	0.99	Smelter Avenue has vital importance for non-motorized connectivity for adjacent neighborhoods. 2013 realized new widened sidewalks from Riverview Blvd NW to 3rd Street NW. This project reiterates the recommendation for bike lanes from 6th Street NW to Riverview Blvd NW (2009 LRTP Update), however it also recommends continuing them to 3rd Street NW to reduce the need for bicyclists to weave across traffic to access the sidepath and to offer options for those who would rather ride on the street. The street is wide enough for bike lanes with a 52-foot typical section (where it has been improved). Additional curb/gutter/sidewalk work is needed where the street has not yet been improved. Parking would be prohibited at the extreme western extent for a short interval.	$12,900
BIKE-31	**9th St N** *8th Ave N to River Dr N*	0.17	North of railroad tracks, widths get tight. Option in this area is to provide one-way travel on sidewalk and ramp down near tracks to bike lanes converted from existing shoulder/parking lanes. Parking lanes not needed along this stretch. Convert parking lanes to bike lanes. Recommend using 10 feet as 6-foot bike lanes with 3 to 4 feet of buffer space	$2,300
BIKE-32	**3rd Ave S** *River's Edge Trail to 2nd St S*	0.13	Road is 40 feet wide with two lanes. All businesses along it have large surface parking lots. 2012 volumes are 4,300 vpd. This connects on-street users to the RET. Ideally the westbound approach to River Drive S would have a through bike lane to connect with the trail. This was recommended as a bike route in the 2009 LRTP Update.	$1,600
BIKE-33	**Smelter Ave NE** *3rd St NW to Western Walmart Entrance*	0.17	For this segment the existing shoulders are not large enough for buffered bike lanes (at least on the north side). Mark pavement for conventional bike lanes.	$1,300
BIKE-34	**Division Rd** *3rd St NW to Smelter Ave NE*	0.26	Recommendation in the 2009 LRTP Update. Road is 40 feet wide. Recommend 14-foot travel lanes and 6-foot bike lanes.	$3,000
BIKE-35	**River Dr N** *15th St N to 38th St N*	1.95	If River Drive North is improved to a 3-lane arterial section, an assessment to the viability of this non-motorized amenity should be made as public sentiment and stakeholder feedback has identified this route as an important gap in the visionary bicycle network for the community.	$19,700
BIKE-36	**25th St S** *15th Ave S to 10th Ave S*	0.2	If 25th Street South is converted to a one-way street, south of 10th Avenue South, it makes sense to continue the bike lane south of 10th Avenue South. Depending on configuration there could be one travel lane and a bike lane with two parking lanes, or on-street parking could be prohibited. However, in this area parking seems well utilized.	$1,200

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-37	**13th St S** *21st Ave S to 24th Ave S*	0.15	If roadway is ever reconstructed bike lanes should be included.	$1,700
BIKE-38	**5th St N** *2nd Ave N to Park Dr N*	0.26	Travel volumes are relatively low (ADT under 2,000 vpd). This street will function well with a single travel lane and buffered bike lanes. Alternatively, on-street parking could be prohibited as most residences front side streets and businesses have off-street lots.	$2,100
BIKE-39	**6th St SW** *Country Club Blvd to Central Ave W*	0.91	Shoulders are already 10 feet wide. Designating existing wide shoulders as bike lanes has been done in Kalispell and Missoula on similar roadways. Prohibit non-emergency parking. Bike lane should be buffered, if possible, by putting a 2- to 3-foot buffer between the travel lane and bike lane.	$10,400
BIKE-40	**Fox Farm Road** *Cherry Dr to Country Club Blvd*	0.13	Currently 5-lane section with ADT of 12,760 vpd just south of Country Club Blvd (becomes 10th Avenue South). Typical section could be narrowed to a single travel lane in each direction, with a wide buffered bike lane, with little significant impact to traffic congestion. Approach lanes at Country Club Blvd would be maintained if possible.	$6,600
BIKE-41	**1st Ave S** *Park Dr S to 10th St S*	0.73	Recommendation taken from the Downtown Great Falls Access Circulation and Connectivity Study - this buffered bike lane was the preferred alternative. Section includes 5-foot one-way bike lane, a 3-foot travel lane buffer, and a 2-foot parking side buffer (in addition to travel lanes).	$9,500
BIKE-42	**2nd Ave S** *2nd St S to 6th St S*	0.33	Recommendation taken from the Downtown Great Falls Access Circulation and Connectivity Study - this buffered bike lane was the preferred alternative. Section includes 5-foot one-way bike lane, a 3-foot travel lane buffer, and a 2-foot parking side buffer (in addition to travel lanes).	$6,600
BIKE-43	**2nd Ave S** *7th St S to 15th St S*	0.65	From 7th Street South to 15th Street South, drop one of the two travel lanes and provide a buffered bike lane. ADT is just under 1,850 vpd, and at two one-way lanes there is excess capacity - even with a single travel lane. Recommend buffered bike lane aligning with wider section to the west. Provide travel lane and parking lane side buffers.	$9,300
BIKE-44	**5th St** *6th Ave S to 2nd Ave N*	0.41	Recommendation taken from the Downtown Great Falls Access Circulation and Connectivity Study - this buffered bike lane was the preferred alternative. Section includes 5-foot one-way bike lane, a 3-foot travel lane buffer, and a 2-foot parking side buffer (in addition to travel lanes).	$7,100
BIKE-45	**6th St S** *5th Ave S to 2nd Ave N*	0.36	Recommendation taken from the Downtown Great Falls Access Circulation and Connectivity Study - this buffered bike lane was the preferred alternative. Section includes 5-foot one-way bike lane, a 3-foot travel lane buffer, and a 2-foot parking side buffer (in addition to travel lanes).	$6,700
BIKE-46	**2nd Ave S** *6th St S to 7th St S*	0.08	Continue the buffered bike lane to the east one block from the Downtown study's recommendations	$1,400
BIKE-47	**6th St NW** *Central Ave W to NW Bypass*	0.42	Street is currently 4 lanes with a center median that controls access and provides space for left turn bays. MDT's traffic counts indicate a 2011 ADT of 9,780 vpd, with a peak ADT of 10,740 vpd (in 2010). This is well below the available capacity of a 3-lane cross-section. To add a bike lane (which the 2009 LRTP Update recommends) will require removing a travel lane. This results in between 10 and 11 feet of space being available on each side of the road. This plan recommends a 7-foot bike lane with a 3-foot buffer area. At intersections where a right turn bay is needed the buffered bike lane can terminate with shared lane markings leading bicyclists along the left edge of the right only lane.	$9,800

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-48	**14th St** *10th Ave S to River Dr N*	1.15	This street currently experiences volumes ranging from 5,300 vpd to 7,000 vpd (ADT) with two southbound travel lanes and a 9-foot parking lane. Speed limit is 30 mph, making shared lane use less desirable. Parking is somewhat utilized, however most homes/businesses have ample parking in off-street areas or with frontage on side-streets. Bicycle warning signs are posted along the corridor. Due to the few stops and signalized crossings, this is an attractive fast through route for bicyclists. The recommended facility type is a buffered bicycle lane. This can be achieved via the following two options: Option 1: The parking lane can be removed to provide a 9-foot bicycle area, with a 6-foot wide bike lane and a 3-foot buffer. This would be the most desirable option. Option 2: The road could still likely function well with a single travel lane given the volumes. The buffered bicycle lane could exist either between the parking lane and the driving lane, or on the side of the road with no parking. The buffered bike lane could become an 'add lane' turn bay with shared lane markings where necessary to improve intersection level of service. A conventional bike lane could also be considered. The street is approximately 32 feet wide. If travel lanes were reduced to 10 feet, and the parking lane reduced to 7 feet, a 5-foot bike lane could be provided. However, all of these dimensions are at the absolute minimum of current engineering practice. The 2009 LRTP Update recommended bike lanes north of 8th Avenue North in Bike-18.	$11,100
BIKE-49	**15th St** *10th Ave S to River Dr N*	1.18	This street currently experiences volumes ranging from 6,400 vpd to approximately 7,400 vpd (ADT), with two northbound travel lanes and a 9-foot parking lane. Speed limit is 30 mph, making shared lane use less desirable. Parking is somewhat utilized, however most homes/businesses have ample parking in off-street areas or with frontage on side-streets. Bicycle warning signs are posted along the corridor. Due to the few stops and signalized crossings, this is an attractive fast through route for bicyclists. The recommended facility type is a buffered bicycle lane. This can be achieved via the following two options: Option 1: The parking lane can be removed to provide a 9-foot bicycle area, with a 6-foot wide bike lane and a 3-foot buffer. This would be the most desirable option. Option 2. The road could still likely function well with a single travel lane given the volumes. The buffered bicycle lane could exist either between the parking lane and the driving lane, or on the side of the road with no parking. The buffered bike lane could become an 'add lane' turn bay with shared lane markings where necessary to improve intersection level of service. A conventional bike lane could also be considered. The street is approximately 32 feet wide. If travel lanes were reduced to 10 feet, and the parking lane reduced to 7 feet, a 5-foot bike lane could be provided. However all of these dimensions are at the absolute minimum of current engineering practice. The 2009 LRTP Update recommended bike lanes north of 8th Avenue North in Bike-18.	$11,300
BIKE-50	**1st Ave S** *10th St S to 15th St S*	0.41	ADT is just under 2,000 vpd. At two one-way lanes, there is excess capacity even with a single travel lane. Recommend buffered bike lane aligning with wider section to the west. Provide travel lane and parking lane side buffers.	$6,600

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-51	**25th St** *10th Ave S to 8th Ave N*	0.93	This street currently experiences volumes ranging from 3,000 vpd to approximately 7,000 vpd (ADT), with two southbound travel lanes and a 9-foot parking lane. Speed limit is 30 mph, making shared lane use less desirable. Parking is somewhat utilized, however most homes/businesses have ample parking in off-street areas or with frontage on side-streets. Bicycle warning signs are posted along the corridor. Due to the few stops and signalized crossings, this is an attractive fast through route for bicyclists. The recommended facility type is a buffered bicycle lane. This can be achieved via the following two options: Option 1: The parking lane can be removed to provide a 9-foot bicycle area, with a 6-foot wide bike lane and a 3-foot buffer. This would be the most desirable option. Option 2: Less likely, but it is possible that the road could still function with a single travel lane given the volumes. The buffered bicycle lane could exist either between the parking lane and the driving lane, or on the side of the road with no parking. The buffered bike lane could become an 'add lane' turn bay with shared lane markings where necessary to improve intersection level of service. A conventional bike lane could also be considered. The street is approximately 32-34 feet wide. If travel lanes were reduced to 10 feet, and the parking lane reduced to 7 feet, a 5-foot bike lane could be provided. However all of these dimensions are at the absolute minimum of current engineering practice. This recommendation was depicted as a bike lane in the 2009 LRTP Update.	$9,300
BIKE-52	**26th St** *10th Ave S to 8th Ave N*	0.92	This street currently experiences volumes ranging from 3,000 vpd to approximately 4,500 vpd (ADT), with two northbound travel lanes and a 9-foot parking lane. Speed limit is 30 mph, making share lane use less desirable. Parking is somewhat utilized, however most homes/businesses have ample parking in off-street areas or with frontage on side-streets. Bicycle warning signs are posted along the corridor. Due to the few stops and signalized crossings, this is an attractive fast through route for bicyclists. The recommended facility type is a buffered bicycle lane. This can be achieved via the following two options: Option 1: The parking lane can be removed to provide a 9-foot bicycle area, with a 6-foot wide bike lane and 3-foot buffer. This would be the most desirable option. Option 2: Less likely, but it is possible that the road could still function with a single travel lane given the volumes. The buffered bicycle lane could exist either between the parking lane and the driving lane, or on the side of the road with no parking. The buffered bike lane could become an 'add lane' turn bay with shared lane markings where necessary to improve intersection level of service. A conventional bike lane could also be considered. The street is approximately 32-34 feet wide. If travel lanes were reduced to 10 feet, and the parking lane reduced to 7 feet, a 5-foot bike lane could be provided. However all of these dimensions are at the absolute minimum of current engineering practice. This recommendation was depicted as a bike lane in the 2009 LRTP Update.	$9,300
BIKE-53	**3rd St NW** *Central Ave W to Smelter Ave*	1.12	10-12 foot shoulders currently exist on this stretch of 3rd Street NW. With bicycle stencils and signs, bike lanes could be created. It is recommended to provide a 7-foot bike lane and a 3-footbuffer to provide a greater feeling of separation. As the road is resurfaced in the future, opportunities should be utilized to provide through bike lanes into the intersections. ADT volumes are 14,000 vpd to 17,000 vpd.	$12,800

ID	Location	Length (miles)	Notes	Estimated Cost
BIKE-54	**Smelter Ave** *West Walmart Entrance to 10th St NE*	0.38	Shoulders are wide enough for buffered bike lanes on this segment of Smelter Avenue. If deceleration lanes are strongly desired, they can be shared lanes, with shared lane markings down the middle. Making them as short as possible will be crucial to reduce the speed differential.	$4,300
BIKE-55	**5th St S** *10th Ave S to 6th Ave S*	0.2	Travel volumes are relatively low (2,500-3,000 vpd). A buffered bike lane could be maintained until half a block south of 9th Avenue South where the street would revert to existing for intersection capacity. Alternatively, on-street parking could be prohibited as most residences front side streets and businesses have off-street lots.	$2,500
BIKE-56	**6th St S** *10th Ave S to 5th Ave S*	0.26	ADT volumes are 2,500 vpd - 3,000 vpd). On-street parking could be prohibited as most residences front side streets and businesses have off-street lots.	$3,000
BIKE-57	**6th St N** *2nd Ave N to 8th Ave N*	0.31	ADT volumes are 800 vpd - 1,500 vpd). This street would function well with a single travel lane and buffered bike lanes. Alternatively, on-street parking could be prohibited as most residences front side streets and businesses have off-street lots.	$3,400

TOTAL BIKE LANE PROJECTS: $429,500

Shared Use Paths

A shared use path provides pedestrian and bicycle travel on a paved right-of-way completely separated from any street or highway. The River's Edge Trail is an example of a shared use path. Shared use paths in the Great Falls area are designed at a minimum to be ten feet wide. **Table 9** depicts locations that should be considered for shared use paths.

Table 10: Recommended Shared Use Paths

ID	Location	Length (miles)	Notes	Estimated Cost
SUP-1	**University of Great Falls Connector** *Administration Complex to Providence Hall*	0.06	Provides an east-west bike route in a section of the city that lacks connectivity.	$41,600
SUP-2	**Clara Park Path** *Ella Ave to 47th St S*	0.16	Formalize existing goat trail. Replaces Bike-4 from 2009 LRTP Update, which recommends 8th Avenue.	$77,300
SUP-3	**Lions Park Path** *27th St S to 29th St S*	0.15	Connects 9th Avenue South. Replaces Bike-4 from 2009 LRTP Update, which recommends 8th Avenue.	$73,500
SUP-9	**Westgate Development Master Plan Pathway** *17th Ave NE to Smelter Ave*	0.23	Part of Westgate Development Master Plan by CTA Architects.	$152,700
SUP-10	**Meadowlark Dr Connector** *Meadowlark Dr to Existing Country Club Blvd/Bridge Path*	0.38	From the Bike-8 recommendation in the 2009 LRTP Update. Uses existing underpass and connects to path along north side of bridge.	$247,400
SUP-11	**BNSF Rail Trail** *14th St SW to 13th Ave SW*	0.43	Connects River's Edge Trail to the Marketplace (with underpass).	$728,600
SUP-12	**Gore Hill Connection** *1st West Hill Dr to Air Cargo Drive*	0.22	Connection to airport on west side of I-90 per request of MPO.	$104,700

ID	Location	Length (miles)	Notes	Estimated Cost
SUP-13	**67th Street N** *18th Ave N to River's Edge Trail*	0.35	From the Bike -16 recommendation in the 2009 LRTP Update.	$165,200
SUP-14	**15th St N Connector Trail** *15th St N to 19th St N*	0.33	As recommended in Bike-18 recommendation in the 2009 LRTP Update. If deemed feasible, a trail descending to the existing River's Edge Trail as close as possible to the 15th Street North bridge would be preferred, as it would better serve trail users wanting to go west.	$157,300
SUP-16	**South of Hospital Trail** *23rd St S to 29th St S*	0.5	To be completed as land develops. Easements at least with plat as construction may be optimized as one project, or in greater batches than by parcel.	$329,000
SUP-17	**10th St Bridge Rehabilitation** *River Dr N to N River Rd*	0.2	If the 10th Street Bridge is ever rehabilitated.	$1,969,700
SUP-18	**6th St N Access Ramps** *River's Edge Trail to River's Edge Trail*	0.08	Access down to 6th Street North from River's Edge Trail.	$49,800
SUP-19	**River Drive South Trail** *1st Ave N to 3rd Ave S*	0.33	Will stay on the riverbank under the RR bridge, between River Drive South and the river. Results in no “at-grade” road crossings.	$1,441,800
SUP-20	**10th Ave N Sidepath** *38th St N to 57th St N*	1.17	Connects existing path and downtown system to Malmstrom AFB.	$556,100

TOTAL SHARED USE PATH PROJECTS: $7,020,100

5.4. Spot Improvements

Improvements that are recommended at specific locations rather than along a corridor are known as spot improvements. These could include signalization, crossing improvements, 4-way stop control, streetscape, trail connections or other small connections fall under this category. Crosswalks and intersection improvements are another type of spot improvement, or a recommendation to improve the non-motorized transportation system by simultaneously improving the roadway network for all users. Crosswalks allow pedestrians and other non-motorized users to cross streets in predictable and designated places.

Bicycle and pedestrian facilities may be also able to be accommodated once a roadway's shoulders are widened or improved. This type of improvement is typically found in non-urban settings. Areas where shoulder widening can be accommodated are include in **Table 11** along with the locations of other recommended bike and pedestrian spot improvements.

Table 11: Recommended Spot Improvements

ID	Improvement	Type	Notes	Estimated Cost
Pedestrian Spot Improvements				
SPOT-1	**NW Bypass & 3rd St NW**	Crosswalks	"T" intersection (i.e. three-legs). Crosswalks are faded on the west and north leg of intersection and non-existing on the south leg. Because of high traffic volumes, ladder crossings (high-visibility) are recommended in order to maintain appearance of crosswalks and designated pedestrian space. Consider adding 'pork chop' islands on both directions on the NW Bypass legs to reduce pedestrian crossing distance.	$11,900
SPOT-2	**Ave B NW & 9th St NW**	Crosswalks	Near school.	$2,800
SPOT-3	**23rd Ave NE & Jaycee Park**	Crosswalks	Access to/from playground and pool. Some parking spaces may need to be removed in order to accommodate a safe crosswalk.	$1,500
SPOT-4	**23rd Ave NE & 4th St NE**	Crosswalks	Add crosswalks on all sides of intersection.	$2,800
SPOT-5	**2nd Ave N & 7th St N**	Crosswalks	Crosswalks, traffic calming, and increased speed limit enforcement will benefit high pedestrian traffic (especially during school year) that is produced by Whittier and the Community Rec Center.	$1,300
SPOT-6	**2nd Ave N & 8th St N**	Crosswalks	Crosswalks, traffic calming, and increased speed limit enforcement will benefit high pedestrian traffic (especially during school year) that is produced by Whittier and the Community Rec Center.	$1,300
SPOT-7	**3rd Ave S & 46th St S**	Crosswalks and Sidewalks	Provide crosswalks on northern and eastern legs of intersection; provide sidewalk along 46th Street South to curb line.	$6,100
SPOT-8	**10th Ave S & 18th St S**	New Ped Signal or Hybrid Beacon	There are no pedestrian crossings between 15th and 20th Streets (5 pedestrian crashes have been reported in this section).	$103,400
SPOT-9	**10th Ave S & 29th St S**	New Ped Signal or Hybrid Beacon	There are no pedestrian crossings between 26th and 32nd Streets (5 pedestrian crashes have been reported in this section).	$103,000
SPOT-10	**4th Ave S & 9th St S**	Crosswalks	Near recorded pedestrian crashes on 9th St; mark crossings with yield signs and lines.	$4,100
SPOT-11	**5th Ave S & 9th St S**	Crosswalks	Near recorded pedestrian crashes on 9th St; mark crossings with yield signs and lines.	$4,100
SPOT-12	**8th Ave S & 9th St S**	Crosswalks	Near recorded pedestrian crashes on 9th St; mark crossings with yield signs and lines.	$4,100

ID	Improvement	Type	Notes	Estimated Cost
SPOT-13	**25th Ave NE & 8th St NE**	4-Way Stop	Convert two-way (east-west) stop to a full, four-way stop. Near school, lower speeds.	$800
SPOT-14	**3rd St NW & River's Edge Trail**	Trail Connection	Connect NW Bypass & 3rd St NW to West Bank Park and the River's Edge Trail	$55,800
SPOT-15	**1st Ave N & Park Dr**	Intersection Improvement	Accessing Gibson Park difficult from downtown. Improve crossing by prioritizing pedestrian traffic on porkchops, and by improving signal timing (leading pedestrian interval).	$6,100
SPOT-16	**2nd Ave S / Park Drive** *2nd Ave S to 1st Ave S*	Streetscape	Sidewalk is lacking in this area, though there is plenty of paved surface. Cars are parking where pedestrians would be walking. Suggest creating a new streetscape with pullouts for parking and a defined sidewalk that has curb separation.	$11,500
SPOT-17	**Smelter Ave NE** *8th St NE to 10th St NE*	Streetscape	Sidewalk needs to be defined - ideally some access management could occur along here as well.	$25,300
Bicycle Spot Improvements				
SPOT-18	**Upper River Rd** *40th Ave S to Overlook Dr*	Shoulder Widening	If road is ever rebuilt, provide at least four feet of rideable shoulder. If rumble strips are considered, widen shoulder design to allow for four feet of rideable width. This is a modification of the Bike-17 recommendation from the 2009 LRTP Update.	$1,713,600
SPOT-19	**Lower River Rd** *40th Ave S to Overlook Drive*	Shoulder Widening	If road is ever rebuilt, provide at least four feet of rideable shoulder. If rumble strips are considered, widen shoulder design to allow for four feet of rideable width. This is a modification of the Bike-20 recommendation from the 2009 LRTP Update.	$859,700
SPOT-20	**25th St N & River Dr**	Trail Connection	Investigate viable neighborhood connections between 25th St N and River's Edge Trail. Incorporate bicycle and pedestrian needs with River Drive improvements in this location.	Unknown
SPOT-21	**14th St SW & 20th Ave SW**	Railroad Tunnel	Connects River's Edge Trail to the Marketplace.	$394,000
SPOT-22	**15th St N & River Dr**	Intersection Improvement	Facilitate connections from 15th Street North to new trail connection.	$12,900
SPOT-23	**Central Ave W & I-15**	Travel Lane Reduction	Remove travel lane on north side for bike lane/shoulder.	$20,000
SPOT-24	**Central Ave W & RR Crossing**	Remove Raised Median	Remove raised median and provide bike lane.	$50,000
SPOT-25	**Fox Farm Rd & 33rd Ave S**	General Roadway Improvement	Improve south of development, in addition to providing bike lanes where most people live. The undeveloped section of this road is where most open house and survey suggestions were identified (of those within this neighborhood) and it is also where a fatal crash occurred.	Unknown
SPOT-26	**4th Ave S & 19th St S**	Improve Existing Full Roadway Closure	Make this an obvious part of a bicycle route rather than just bollards sticking out of the concrete. Ensure adequate bicycle passage clearance and include pavement markings and wayfinding signage.	$2,900
SPOT-27	**4th Ave S & 18th St S**	Improve Existing Full Roadway Closure	Make this an obvious part of a bicycle route rather than just bollards sticking out of the concrete. Ensure adequate bicycle passage clearance and include pavement markings and wayfinding signage.	$2,900
SPOT-28	**Fox Farm Rd & 18th Ave S**	Intersection Signalization Improvement	Possible RRFB.	$25,500
SPOT-29	**19th St N Intersection**	Intersection Improvement	Evaluate and install enhanced non-motorized crossing treatments to River's Edge Trail.	$40,000

TOTAL SPOT IMPROVEMENT PROJECTS: $3,467,400

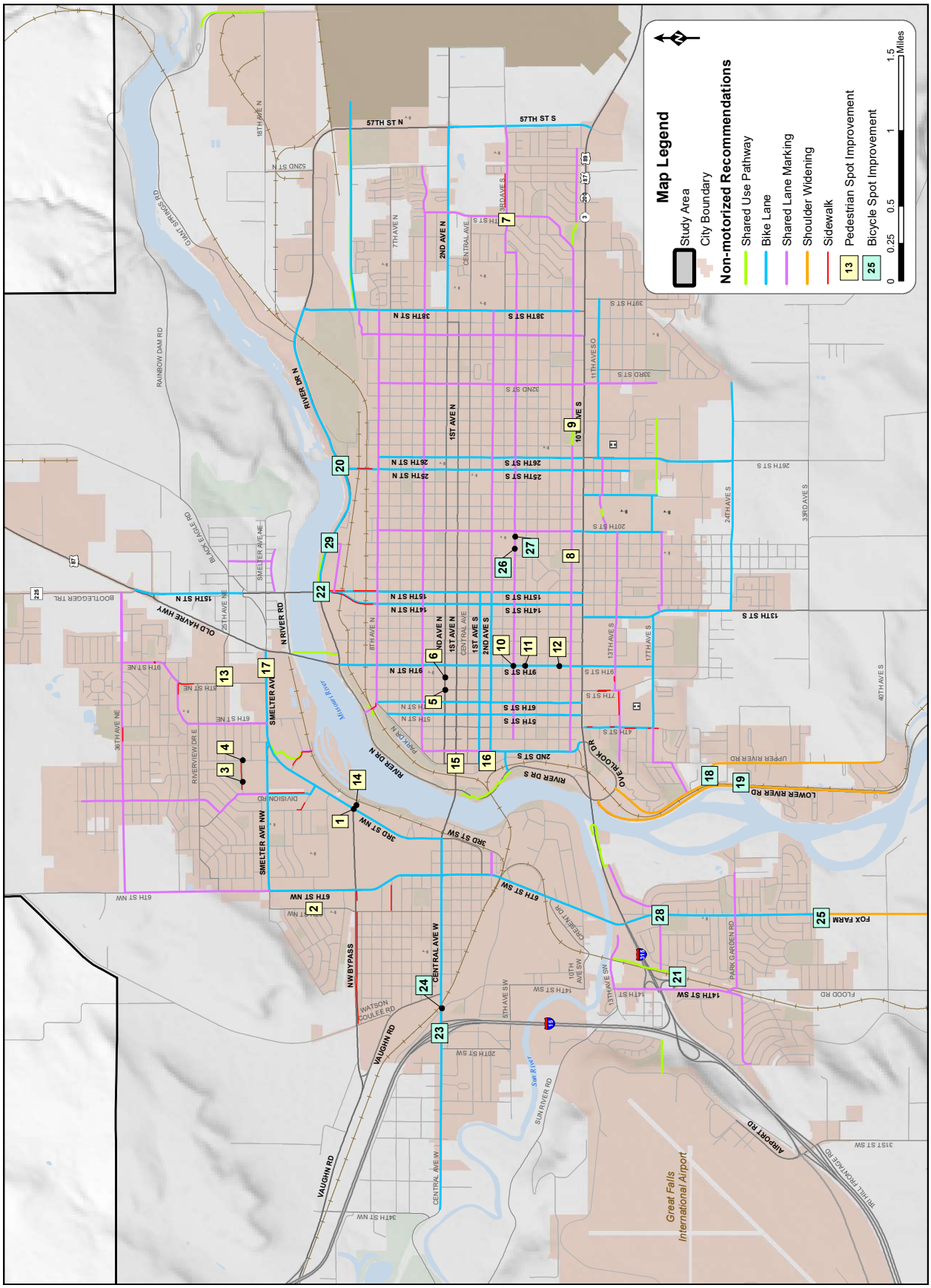


Figure 3: Non-Motorized Recommendations

6.0 TRANSIT IMPROVEMENTS

Public transportation services in the Great Falls area take the form of fixed-route passenger bus service operating on a scheduled service, and "demand-responsive" bus/van service providing door-to-door service for the elderly and those unable to use the fixed-route service. Public transit has been characterized in the Great Falls Area as a service for transit dependents. With one hour gaps between buses, loop routes that add time and inconvenience to bus travel, and lack of support facilities such as connecting sidewalks, bus pads, and stop amenities, service is minimal.

The LRTP envisions an integrated multimodal transportation system that meets sustainable growth expectations, supports economic vitality, and improves quality of life. To achieve this vision, transit must play a much greater role in providing travel choice within the Great Falls Area. This includes increased service frequency, longer service hours, and expanded coverage.

6.1. Planned Committed Improvements

Due to extensive funding limitations, there are few “committed” projects on the horizon concerning transit. Transit District personnel have reiterated that due to limited funds, they are essentially in a survival mode. Although their recent TDP identified a number of short-term and long-term improvements, none have been implemented due to funding constraints.

Transit service requires a bus fleet and spares. If transit service is to be expanded over time to increase frequency and add coverage area, this fleet needs to expand. In order to be competitive, the buses need to be replaced when approximately 12 years old. With an aged fleet, there are several drawbacks that impact customer satisfaction. Vehicle reliability is not as good as a more modern fleet, leading to an increased number of road failures and service disruptions. Customers are not given the advantage of new technology, such as improvements in seating, accessibility, and comfort when older equipment is kept in service beyond its useful life. Associated with a larger fleet is the requirement for servicing these buses and an improved/expanded fleet facility

As of the 2014 LRTP, there were 21 fixed-route vehicles and nine paratransit vehicles in the existing transit fleet. Seven of the fixed-route buses were 19 years old and had exceeded their useful life, and another four were 11 years old. Although the TDP identified a handful of recommendations, inadequate funding for vehicles and additional drivers dictate that these items be placed on hold. These improvements are described in greater detail in the following section. Route changes coincident to these recommendations are as shown on **Figure 4**.

Fleet replacement on a designated four-year cycle is the most pressing transit need to continue successful operations. As the older vehicles are cycled out of the fleet, and a consistent replacement cycle is realized, GFT will turn attention to other recommendations in the TDP such as installation of bus stops, shelters and route service changes.

6.2. Recommended Improvements from TDP Update

The TDP prepared as a part of past planning efforts identified several service design needs and fixed stop considerations that were recommended for implementation. The Great Falls Transit District plans to eventually implement the recommendations upon realization of improved funding mechanisms. The needs as identified are as follows:

Short-Term (1-3 Years)

A "preferred service plan" was chosen in conjunction with Great Falls Transit staff from the available transit service information and options in the TDP analysis. The preferred service seeks to provide a high level of quality service to residents of Great Falls at minimal additional cost. The TDP estimates the increase in cost to implement the preferred service plan to be $250,000. The additional costs are due to operating an additional vehicle all day (due to splitting Route 1) and the increased mileage on Route 7 (due to the decreased headway). The preferred service is presented in **Figure 4**.

As shown in the figure, Route 1 would be split into two segments—east and west. The east portion of the route will be referred to as Route 1, while the western portion will become Route 8. Splitting this route into two segments provides multiple benefits for the rider. Individuals would now have access to 9th Avenue South stops, which provide access to 10th Avenue South locations as well. In addition, users of Route 1 would have a shorter travel time to Benefis East from downtown.

Route 7 would also be altered to provide a more direct route to the Great Falls Marketplace, which will allow it to be on a 30-minute headway. The portion of Route 7 that was operating in the northwest portion of the city is being covered by Route 5. This change eliminates some of the duplication that was present in the previous service, while allowing for better headways on Route 7. The rest of the routes remain unchanged.

To implement the preferred service plan, an additional vehicle will be required and higher operational costs with an estimated amount of $250,000 may be realized.

Long-Term (4-5 Years)

A more long-term goal for Great Falls Transit is to provide evening service for passengers. Although providing Sunday service was a comment made during various surveys associated with the TDP, it is not a reasonable or feasible service change within the five-year horizon due to funding limitations and more pressing needs. Current service ends at approximately 6:30 PM, which is not late enough for some users. The option that was examined in the TDP report extends fixed-route service 30 minutes (until 7:00 PM) and provides demand-responsive service thereafter. Providing evening service in this manner will allow Great Falls Transit to provide evening service in a cost-effective way, as the demand will likely not be substantial during the onset of service extension. The estimated cost to extend service until 7:00 PM, with demand-responsive service thereafter until 10:00 PM, is $164,000. Four vehicles are likely needed to provide this service during the time span. As the service is demand-responsive, the number of vehicles required can be changed fairly easily to match the demand of the general public. This cost estimate includes extending the fixed-route service 30 minutes as well as providing three hours of general public demand-response service. While this option is listed in the implementation plan as beginning in four to five years, it is contingent on funding increases and seen as a long-term goal, compared to the route reconfigurations mentioned above under "short-term" goals.

To extend fixed-route service an additional 30 minutes, and provide demand-responsive service thereafter until 10 PM, four vehicles will need to be allocated to the extension, with an overall estimated operational cost of $164,000.

Service Schedules

The overall service concept of the system remains the same. Headways are generally at one hour during off-peak periods (with the exception of Route 7 that will be 30 minutes all day) and 30 minutes during peak periods. New schedules are identified for Route 5, Route 7, Route 1, and Route 8. Note that daily boardings for GFTD were analyzed in the TDP by various times of the day by route to identify "peak periods". The total boardings were broken down by time period and route, and the percentage of total

boardings for various time periods and routes were calculated. The number of passengers by time period determines the boarding patterns during various times of the day, which helps determine peak load times, peak-hour vehicle allocations, and schedules. The following information was determined from the analysis for four time periods:

- Prior to 9 AM 18.4% of total boardings
- 9 AM – Noon 21.2% of total boardings
- Noon – 3 PM 28.0% of total boardings
- After 3 PM 32.5% of total boardings

Routes that are maintaining their current alignment also have a minor schedule change. The current schedules provide for a 15-minute break in the middle of the day to ensure that afternoon schedules better align with passenger needs and to give drivers a lunch break. These 15-minute breaks occur at the outbound terminus of each route. Because the service gap occurs on the outbound portion of the route, many riders must wait for 15 minutes at Noon's, the Twilite Center, or Great Falls Marketplace. By making a minor change to the schedule and allowing for that break to occur at the downtown transfer center, passengers will have access to the transfer facility and downtown amenities during this break.

Great Falls Transit should coordinate with the local schools to ensure that students are able to use transit for travel to and from school. This may require minor changes to the proposed schedules or adjustments to school start and stop times.

Fixed Stops

Great Falls Transit currently uses a flag stop system for their fixed-route service. Buses will stop at any safe location along a route, preferably near an intersection. While this service provides a great deal of flexibility for the rider, it can be confusing for new or infrequent users to determine where a potential stop may be. The amount of current ridership being experienced by Great Falls Transit is conducive to creating fixed stops for service. Boarding and alighting data show users boarding in primary locations throughout the core service area. The creation of fixed stops will still allow users to board at convenient locations, if they are placed properly.

The addition of fixed stops will allow Great Falls Transit to have greater visibility to the passenger. Knowing that standing at a designated location will result in a transit vehicle passing by provides reassurance to riders, especially those that may be unfamiliar with the system. This may also reduce some of the confusion that is associated with benches currently located throughout the city that are not affiliated with Great Falls Transit.

Bus stops should be placed at least every 1,000 feet, which equates to roughly each two blocks. Boarding and alighting data can be used to help determine the best potential locations for stops. All attempts should be made to place bus stop signs in the most accessible locations for passengers.

In addition to including fixed bus stops, shelters should be placed at the locations with the highest amount of activity. Great Falls Transit currently provides shelters at a few locations that denote transit stops. Placing shelters at popular boarding locations such as Benefis West, Benefis East, Westwood Shopping Center, and Walmart gives passengers better protection from the elements and once again provides Great Falls Transit with greater visibility.

The potential costs to realize fixed stops and shelters at high activity locations range from a potential year one cost of approximately $50,000 (assumes adding five shelters in year one) to $20,000 for years two through five (assumes two new shelters per year).

Development Review

As Great Falls continues to grow at the fringe, newly developed areas should be evaluated for transit need. Great Falls Transit should have a presence in the development review process for the city. This will allow future projects to be considered by Great Falls Transit and for their transit need to be determined. Great Falls Transit would then have the ability to discuss the feasibility of providing transit to a development during the planning stages. Great Falls Transit would also have firsthand knowledge of planned developments so that service changes can be considered and evaluated well before the development is completed.

APPENDIX G:
Additional Considerations



ADDITIONAL CONSIDERATIONS

April 12, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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ABBREVIATIONS / ACRONYMS

CSS	Context Sensitive Solutions
GRH	Guaranteed Ride Home
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LRTP	Long Range Transportation Plan
MDT	Montana Department of Transportation
MRTMA	Missoula Ravalli Transportation Management Association
NEPA	National Environmental Policy Act
PSA	Public Service Announcement
SOV	Single Occupancy Vehicle
TDM	Transportation Demand Management
TOD	Transit Oriented Development
TWLTL	Two-Way Left-Turn Lane

ADDITIONAL CONSIDERATIONS

1.0 INTRODUCTION

This memorandum addresses several topics for the Great Falls Area Long Range Transportation Plan (LRTP) that link the transportation system to broader quality of life considerations within the community. Federal regulations require the LRTP to "include both long-range and short-range program strategies/actions that lead to the development of an integrated intermodal transportation system that facilitates the efficient movement of people and goods." While this is obviously a key consideration, it must be recognized that the design, modal mix, and location of transportation infrastructure and facilities can directly affect urban form and functions and community character.

Current directions in transportation planning place importance on developing transportation systems that help reduce unnecessary travel delays and managing travel demands in ways that create balanced multimodal networks that offer multiple transportation choices. Transportation systems also need to provide facilities and services to help achieve reliable and timely access to jobs, community services, affordable housing, and schools while helping create safe streets and improving economic competitiveness, and enhancing unique community characteristics.

2.0 CORRIDOR PRESERVATION

Corridor preservation is the application of measures to prevent or minimize development within the right-of-way of a planned transportation facility or improvement within a defined corridor. That includes corridors, both existing and future, in which a wide array of transportation improvements may be constructed including roadways, bikeways, multi-use trails, high occupancy vehicle lanes, or fixed route transportation infrastructure.

The objective of corridor preservation is to enable local governments to better plan for future growth. Corridor preservation helps to assure that a transportation system will effectively and efficiently serve existing and future development within a community, region or state, and prevent costly and difficult acquisitions after the fact. Preserving right-of-way for planned transportation facilities promotes orderly and predictable development. As communities expand, land must be set aside for the transportation infrastructure needed to support development and to maintain a desired level of transportation service. The decisions made about the location and design of the transportation network will have a lasting impact on growth patterns, community design, and modal alternatives.

Corridor preservation policies, programs and practices provide numerous benefits to communities, taxpayers and the public at large. These include, but are not limited to, the following:

- **Reducing transportation costs by preservation of future corridors in an undeveloped state.** Right-of-way costs often represent the single largest expenditure for a transportation improvement, particularly in growing urbanized areas where transportation improvement needs are the greatest. By acquiring or setting aside right-of-way well in advance of construction, the high cost to remove or relocate private homes or businesses is eliminated or reduced.

- **Enhancing economic development by minimizing traffic congestion and improving traffic flow, saving time and money.** Low cost, efficient transportation helps businesses contain final costs to customers and makes them more competitive in the marketplace. Freight costs, for

instance, accounts for ten percent of the value of agricultural products, the highest for any industry.

- **Increasing information sharing so landowners, developers, engineers, utility providers, and planners understand the future needs for developing corridors.** An effective corridor preservation program ensures that all involved parties understand the future needs within a corridor and that state, local and private plans are coordinated. Clarifying public intentions about the location, timing, and desired level of access control for roadway improvements reduces the risk associated with the timing and phasing of development projects for the private sector. Advanced notice of such intentions also enables developers to plan projects and site-related improvements in a manner that is more compatible with the planned transportation functions of the corridor.

- **Preserving arterial capacity and right-of-way in growing corridors.** Corridor preservation includes the use of access management techniques to preserve the existing capacity of corridors. When it is necessary, arterial capacity can be added before it becomes cost prohibited by preserving right-of-way along growing transportation corridors.

- **Minimizing disruption of private utilities and public works.** Corridor preservation planning allows utilities and public works providers to know future plans for their transportation corridor and make their decisions accordingly.

- **Promoting urban and rural development compatible with local plans and regulations.** The state and local agencies must work closely together to coordinate their efforts. Effective corridor preservation will result in development along a transportation corridor that is consistent with local policies.

- **Reducing adverse social, economic, and environmental impacts on people and communities.** The social and economic costs of relocation can be high for some communities, particularly low-income, ethnic, or elderly populations and small businesses that serve such populations. In addition, where viable transportation corridors are foreclosed by development, roadways may need to be relocated into more environmentally sensitive areas, thereby increasing adverse impacts on the environment.

A variety of techniques have been applied by communities to help preserve right-of-way for future transportation corridors, ranging from setback ordinances to mandatory dedication. Although many jurisdictions have some method of right-of-way preservation in place, no single method works for all situations. Communities that have been most successful at corridor preservation are those that have assembled a variety of tools that they can mix and match to the circumstances at hand. The following are viewed as important elements of successful corridor preservation programs:

- Develop a long-range transportation plan with broad community support;
- Set clear priorities for transportation improvement projects and complete them in a timely manner;
- Identify a funding source for advance acquisition of necessary or desired rights-of-way; and
- Provide a range of mitigation measures to address potential hardship on property owners and to preserve property rights.

National experience in corridor preservation practices has also shown it is helpful to determine desired design objectives and cross-sections for transportation improvements in the community to establish a basis for future right-of-way needs. This helps to facilitate administration of and public support for the program by identifying in advance the amount of right-of-way that will be needed and why.

3.0 ACCESS MANAGEMENT

Access Management is the proactive management of vehicular access points to land parcels adjacent to all manner of roadways. Good access management promotes safe and efficient use of the transportation network. Access management techniques are increasingly fundamental to preserving the safety and efficiency of a transportation facility. Access control can extend the carrying capacity of a roadway, reducing potential conflicts.

There are six basic principles of access management that are used to achieve the desired outcome of safer and efficient roadways. These principles are:

- Limit the number of conflict points.
- Separate the different conflict points.
- Separate turning volumes from through movements.
- Locate traffic signals to facilitate traffic movement.
- Maintain a hierarchy of roadways by function.
- Limit direct access on higher speed roads.

Access management encompasses a set of techniques that local governments can use to control access to highways, major arterials, and other roadways. Access management includes several techniques that are designed to increase the capacity of these roads, manage congestion, and reduce crashes. These techniques include:

- **Signal Spacing:** Increasing the distance between traffic signals improves the flow of traffic on major arterials, reduces congestion, and improves air quality for heavily traveled corridors.

- **Access and Driveway Spacing:** Fewer driveways spaced further apart allows for more orderly merging of traffic and presents fewer challenges to drivers.

- **Safe Turning Lanes:** Dedicated left- and right-turn, indirect left-turns and U-turns, and roundabouts keep through-traffic flowing. Roundabouts represent an opportunity to reduce an intersection with many conflict points or a severe crash history (T-bone crashes) to one that operates with fewer conflict points and less severe crashes (sideswipes) if they occur.

- **Median Treatments:** Two-way left-turn lanes (TWLTL) and non-traversible, raised medians are examples of some of the most effective means to regulate access and reduce crashes.

- **Service and Frontage Roads:** Helps alleviate congestion on major limited access thoroughfares by providing parallel routes which can separate local traffic from through traffic.

- **Right-of-Way Management:** As it pertains to R/W reservation for future widenings, good sight distance, access location, and other access-related issues.

State, regional, and local governments across the United States use access management policies to preserve the functionality of their roadway systems. This is often done by designating an appropriate level of access control for each of a variety of facilities. Local residential roads are allowed full access, while major highways and freeways allow very little. In between are a series of road types that require standards to help ensure the free flow of traffic and minimize crashes, while still allowing access to major businesses and other land uses along a road.

It is recommended that City and County governments adopt a set of Access Management Regulations through which the need for access management principles can be evaluated on a case-by-case basis.

For roadways on the State system and under the jurisdiction of the Montana Department of Transportation (MDT), access control guidelines are available which define minimum access point spacing, access geometrics, etc., for different roadway facilities.

For other roadways (non-State), the adoption of an access classification system based upon the functional classification of the roadway (principal arterial, minor arterial or major collector) is desirable. These local regulations should serve to govern minimum spacing of drive approaches/connections and median openings along a given roadway in an effort to fit the given roadway into the context of the adjacent land uses and the roadway purpose. The preparation and adoption of a local Access Management Ordinance should be pursued that can adequately document the local government's desire for standard approach spacing, widths, slopes and type for a given roadway classification.

4.0 TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) measures came into being during the 1970s and 1980s in response to a desire to save energy, improve air quality, and reduce peak-period congestion. TDM strategies focused on identifying alternates to single occupant vehicle use during commuting hours. Therefore, such things as carpooling, vanpooling, transit use, walking and bicycling for work purposes are most often associated with TDM. Many of these methods were not well received by the commuting public and therefore, provided limited improvement to the peak-period congestion problem. Due to the experiences with these traditional TDM measures over the past few decades, it became clear that the whole TDM concept needed to be changed. TDM measures that have been well received by the commuting public include flextime, a compressed workweek and telecommuting. In addition to addressing commute trip issues, managing demand on the transportation system includes addressing traffic congestion associated with special events, such as the fireworks display on the 4th of July, Great Falls White Sox baseball games, and other large cultural or sporting events. A definition of TDM follows:

> *TDM programs are designed to maximize the people-moving capability of the transportation system by increasing the number of persons in a vehicle, or by influencing the time of, or need to, travel. (FHWA, 1994)*

Since 1994, TDM has been expanded to also include route choice. A parallel arterial with excess capacity near a congested arterial can be used to manage the transportation system to decrease congestion for all transportation users. In Montana, an excellent model for TDM strategies can be found by examining the Missoula Ravalli Transportation Management Association (MRTMA). MRTMA offers vanpool, carpool, and guaranteed ride home programs and works with employers to tailor specific commute programs for their staff.

The Great Falls area is projected to grow. The accompanying expansion of transportation infrastructure is expensive and usually lags behind growth. Proper management of demand now will maximize the existing infrastructure and delay the need to build more expensive additional infrastructure. TDM is an important and useful tool to extend the useful life of a Transportation System.

4.1. Role of Transportation Demand Management

TDM strategies are an important part of the Great Falls Area Long Range Transportation Plan due to their inherent ability to provide the following benefits to the commuting public:

- Better transportation accessibility;
- Better transportation predictability;
- More, and timelier, information;

- A range of commute choices; and
- Enhanced transportation system performance.

TDM measures can also be applied to non-commuter traffic and are especially easy to adapt to tourism, special events, emergencies and construction. The benefits to these traffic users are similar to those for commuters, and are listed as follows:

- Better transportation accessibility;
- More transportation reliability;
- More, and timelier, information;
- A range of route choices; and
- Enhanced transportation system performance.

These changes allow the same amount of transportation infrastructure to effectively serve more people. They acknowledge and work within the mode and route choices which motorists are willing to make, and can encourage a sense of community. Certain measures can also increase the physical activity of people getting from one place to another.

Such things as alerting the traveling public to disruptions in the transportation system caused by construction or vehicle crashes can manage demand and provide a valuable service to the traveling public.

Overall, congestion can be avoided or managed on a long-term basis through the use of an integrated system of TDM strategies.

4.2. TDM Strategies and Their Effectiveness

TDM strategies, which are or have been used by other communities in the United States, are discussed in this section. By capitalizing on the use of these options, the existing vehicular infrastructure can be made to function at acceptable levels of service for a longer period of time. Ultimately, this will result in lower per year costs for infrastructure replacement and expansion projects, not to mention less disruption to the users of the transportation system.

While some of these options may work well in the Great Falls area, it is clear that some may be inappropriate. Additionally, some of these options are more effective than others. To provide a TDM system that is effective in managing demand, a combination of these methods will be necessary.

Flextime

When provided by employers, flextime allows workers to adjust their commuting time away from the peak periods. This means that employees are allowed some flexibility in their daily work schedules. For example, rather than all employees working 8:00 to 4:30, some might work 7:30 to 4:00, and others 9:00 to 5:30. This provides the workers with a less stressful commute, allows flexibility for family activities and lowers the number of vehicles using the transportation system during peak times. This in turn can translate into reduced traffic congestion, support for ridesharing and public transit use, and benefits to employees. Flextime allows commuters to match their work schedules with transit and rideshare schedules, which can significantly increase the feasibility of using these modes. Costs for implementing this type of TDM strategy can include increased administrative and management responsibilities for the employer, and more difficulty in evaluating an employee's productivity. Flextime is a TDM strategy that has a high probability of being used successfully within Great Falls.

Alternate Work Schedule

A related but more expansive strategy is to provide an alternate work schedule. This strategy involves using alternate work hours for all employees. It would entail having the beginning of the normal workday start at a time other than 8:00 a.m. For example, starting the workday at 7:30 a.m. would allow all employees to reach the work site in advance of the peak commute time. Additionally, since they will be leaving work at 4:30 p.m., they will be home before the peak commute time, and have more time in the evening to participate in family or community activities. This can be a very desirable side benefit for the employees. This has a similar effect on traffic as flextime, but does not give individual employees as much control over their schedules. An alternate work schedule is a TDM strategy that has a high probability of being used successfully within Great Falls.

Compressed Work Week

A compressed work week is different from offering "flextime" or the "alternate work schedule" in that the work week is actually reduced from the standard "five-days-a-week" work schedule. A good example would be employers giving their workers the opportunity to work four (4) ten-hour days a week. A compressed work week reduces commute travel (although this reduction may be modest if employees take additional car trips during non-work days or move farther from worksites). Costs for implementing this type of TDM strategy may be a reduction in productivity (employees become less productive at the end of a long day), a reduction in total hours worked, and it may be perceived as wasteful by the public (for example, if staffing at public agencies is low on Fridays). A compressed work week is a TDM strategy that has a high probability of being used successfully within Great Falls.

Telecommuting

Telecommuting in the work place offers a good chance to reduce the dependence to travel to work via car or bus. This is especially true in technical positions and some fields in the medical industry (such as medical transcription). Additionally, opportunities for distance learning, shopping via computers, basic health care services and recreation also exist and can serve to reduce vehicular travel on the transportation system. Telecommuting is usually implemented in response to an employee request, more so than instigated by the employer. Since telecommuting reduces commute trips, it can significantly reduce congestion and parking costs. It is highly valued by many employees and tends to increase their productivity and job satisfaction. Costs associated with this TDM strategy include increased administrative and management responsibilities, and more difficult evaluation of employee productivity. Some employees find telecommuting difficult and isolating. Telecommuting also may reduce staff coverage and interaction, and make meetings difficult to schedule. Many employers in Montana have tried and currently allow some form of telecommuting. This strategy has a high probability of being used successfully within Great Falls.

Ride Sharing (carpooling)

Carpooling is traditionally one of the most widely considered TDM strategies. The idea is to consolidate drivers of single occupancy vehicles into fewer vehicles, with the result being a reduction in congestion. Carpooling is generally limited to those persons whose schedules are rigid and not flexible in nature. Studies have shown that carpooling is most effective for longer trips greater than ten miles in each direction. Aside for the initial administrative cost of set-up and marketing, ridesharing also may encourage urban sprawl by making longer-distance commutes more affordable.

Transit agencies sometimes consider rideshare as competition that reduces transit ridership. Ridesharing is a strategy that would work within the Great Falls area, especially if set up through the larger employers. An extensive public awareness campaign describing the benefits of this program would help in selling it to the general public.

Vanpooling

Vanpooling is a strategy that encourages employees to utilize a larger vehicle than the traditional standard automobile to arrive at work. Vans typically hold twelve or more persons. Vanpooling generally does not require high levels of subsidy usually associated with a fixed-route or demand-responsive transit service. They can often times be designed to be self-sufficient. The van is typically provided by the employer, or a vanpool brokerage agency, which provides the insurance. The costs of a vanpooling program are very similar to those of ridesharing.

Bicycling

Bicycling can substitute directly for automobile trips. Communities that improve cycling conditions often experience significant increases in bicycle travel and related reductions in vehicle travel. Although this may not be a measurable statistic pertinent to reducing congesting, providing increased bicycling opportunities can help and can also contribute to quality of life issues. Bicycling characteristics within the Great Falls area is primarily recreational in nature, and by implementing the bikeway network improvements, a gradual shift to bicycling as a commuter mode of travel should be realized. Incentives to increase bicycle usage as a TDM strategy include: construction improvements to bike paths and bike lanes; correcting specific roadway hazards (potholes, cracks, narrow lanes, etc.); development of a more connected bikeway street network; development of safety education, law enforcement and encouragement programs; and the solicitation and addressing of bicycling security/safety concerns. Potential costs of this TDM strategy are expenses associated with creating and maintaining the bikeway network, potential liability and accident risks (in some cases), and increased stress to drivers. Bicycling is an excellent, effective TDM strategy that has a great chance for success in Great Falls.

Walking

Walking as a TDM strategy has the ability to substitute directly for automobile trips. A relatively short non-motorized trip often substitutes for a longer car trip. For example, a shopper might choose between walking to a small local store versus driving a longer distance to shop at a supermarket. Incentives to encourage walking in a community can include: making improvements to sidewalks, crosswalks and paths by designing transportation systems that accommodate special needs (including people using wheelchairs, walkers, strollers and hand carts); providing covered walkways, loading and waiting areas; improving pedestrian accessibility by creating location-efficient, clustered, mixed land use patterns; and soliciting and addressing pedestrian security/safety concerns. Costs are similar to that of bicycling and are generally associated with program expenses and facility improvements. As with bicycling, walking is an excellent TDM strategy that has a great chance for success in Great Falls.

Park & Ride Lots

Park and ride lots are effective for communities with substantial suburb to downtown commute patterns. Park and ride consists of parking facilities at transit stations, bus stops and highway on ramps, particularly at the urban fringe, to facilitate transit and rideshare use. Parking is generally free or significantly less expensive than in urban centers. Costs are primarily associated with facility construction and operation. This TDM strategy is not likely to benefit the transportation system within Great Falls.

Car Sharing

Car sharing is a demand reducing technique that allows families within a neighborhood to reduce the number of cars they own and share a vehicle for the limited times when an additional vehicle is absolutely essential. Costs are primarily related to creation, startup and administrative costs of a car sharing organization. This TDM strategy is not likely to benefit the transportation system within Great Falls.

Traditional Transit

Traditional transit service is an effective TDM strategy, especially in a highly urban environment. Several methods to increase transit usage within the community are to improve overall transit service (including more service, faster service and more comfortable service), reduce fares and offer discounts (such as lower rates for off-peak travel times, or for certain groups), and improved rider information and marketing programs. The costs of providing transit depend on many factors, including the type of transit service, traffic conditions and ridership. Transit service is generally subsidized, but these subsidies decline with increased ridership because transit services tend to experience economies of scale (a 10% increase in capacity generally increases costs by less than 10%). TDM strategies that encourage increased ridership can be very cost effective. These strategies may include offering bicycle carrying components on the transit vehicle, changing schedules to complement adjacent industries, etc. Transit as a TDM strategy in Great Falls has a high likelihood of being successful, however funding constraints are the current limiting factor.

Express Bus Service

Express bus service as a TDM strategy has been used by larger cities in the nation as a means to change driver vehicle characteristics. The use of an express bus service is founded on the idea that service between two points of travel can either be done faster or equal to the private automobile (or a conventional bus service that is not “express”). An express bus service TDM strategy would not be applicable to Great Falls.

Installing/Increasing Intelligent Transportation Systems (ITS)

The use of ITS methods to alert motorists of disruptions to the transportation system will be well received by the transportation users, and are highly effective tools for managing transportation demands.

Installing High Occupancy Vehicle (HOV) lanes

High occupancy vehicle lanes would probably have a low cost / benefit ratio and possibly would be ignored in Great Falls. HOV lanes are generally used on very congested roadways where intersections and access control is somewhat limited. They also can be utilized on urban arterials. A HOV is typically described as having two or more persons in the vehicle during the time of travel. The benefits of a HOV lane in a congested corridor is that increased travel speeds and reliability for HOV passengers is realized. The costs include project construction, management and enforcement. Some critics also argue that HOV lanes encourage urban sprawl, contribute to poor air quality, and increase crash rates due to conflicts between vehicles in higher-speed HOV lanes and vehicles in lower speed general use lanes.

Ramp Metering

Ramp metering has been used by some communities and consists of providing a modified traffic signal at on ramps to interstate highway facilities. The use of this TDM strategy would not be applicable to the Great Falls area.

Traffic Calming

Traffic Calming (also called Traffic Management) refers to various design features and strategies intended to reduce vehicle traffic speeds and volumes on a particular roadway. Traffic Calming projects can range from minor modifications of an individual street to comprehensive redesign of a road network. Traffic calming can be an effective TDM strategy in that its use can alter and/or deter driver characteristics by forcing the driver to either use a different route or to use an alternative type of transportation (such as transit, bicycling, walking, etc.). Costs of this TDM strategy include construction expenses, problems for emergency and service vehicles, potential increase in drivers’ effort and

frustration, and potential problems for bicyclists and visually impaired pedestrians. Traffic calming measures are discussed later in this memo.

Identifying and Using Special Routes and Detours for Emergencies or Special Events

This type of TDM strategy centers around modifications to driver patterns during special events or emergencies. They can typically be completed with intensive temporary signing or traffic control personnel. A prime example would be modifying travel patterns after a Voyagers baseball game in Great Falls. Temporary traffic control via signs and flaggers could be implemented to provide a swift and safe exit after applicable events.

Linked Trips

This strategy entails combining trips into a logical sequence that reduces the total miles driven on the surrounding transportation system. These trips are generated by associated facilities within a mixed-use development or within an area of the community where adjacent land uses are varied and offer services that would limit the need to travel large distances on the transportation system. This TDM strategy could be successful in Great Falls, particularly as new developments occur in the future that incorporate mixed uses.

Pay for Parking at Work Sites (outside the downtown area)

TDM measures involving “paying for parking” outside the downtown area or at employers or paying more for single occupant vehicles can be regarded by those impacted as Draconian and may be poorly received in Great Falls.

Higher Parking Costs for Single Occupant Vehicles (SOV)

Intuitively, free parking provided by employers is a tremendous incentive for driving alone. If the driver of a SOV is not penalized in some form, there is no perceived reason not to drive to the workplace. One way to counter this reality is to charge a higher price for parking for the SOV user. In Great Falls, this could possibly be implemented within the downtown area, where parking fees are charged for the eight city-owned parking lots. This implementation strategy is not likely to have much of an impact to the frequency of SOV users on the transportation system.

Preferential Parking for Rideshare/Carpool/Vanpools

This concept ties into the discussion above regarding parking of the SOV user. Preferential parking, such as delineating spaces closer to an office for riders sharing their commute or reduced/free parking, can be an effective TDM strategy.

Subsidized Transit by Employers

A subsidized transit program, typically offered by employers to their employees, consists of the employer either reimbursing or paying for transit services in full as a benefit to the employee. This usually comes in the form of a monthly or annual transit pass. Studies show that once a pass is received by an employee, the tendency to use the system rises dramatically.

Guaranteed Ride Home (GRH) Programs for Transit Riders

The guaranteeing of a ride home for transit users is a wise choice for all transit systems, since it gives the users a measure of calm knowing that they will be able to get home. A GRH program provides an occasional subsidized ride to commuters who use alternative modes, for example, if a bus rider must return home in an emergency, or a car pooler must stay at work later than expected. This addresses a common objection to the use of alternative modes. GRH programs may use taxies, company vehicles or

rental cars. GRH trips may be free or they may require a modest co-payment. The cost of offering this service tends to be low because it is seldom actually used.

Mandatory TDM Measures for Large Employers

Some communities encourage large employers (typically with at least 50 to 100 employees) to mandate TDM strategies for their employees. This is a control that can be required by local governments on developers, employers, or building managers.

The regulatory agencies often times provide incentives for large employers to make TDM strategies more appealing, such as reduced transit fares, preferred parking, etc.

Required Densification / Mixed Use Elements for New Developments

Requiring new developments to be dense and contain mixed-use elements will ensure that these developments are urban in character and have some services that can be reached by biking, walking or using other non-automobile methods. This also relates to the concept of "linked" or "shared" trips presented later in this chapter. As new developments are proposed, local and regional planners have the opportunity to dictate responsible and effective land use to encourage "shared" trips and reduce impacts to the surrounding transportation system.

Transit Oriented Development (TOD)

Transit Oriented Development (TOD) refers to residential and commercial areas designed to maximize access by transit and non-motorized transportation, and with other features to encourage transit ridership. A TOD usually consists of a neighborhood with a rail or bus station, surrounded by relatively high-density development, with progressively lower-density spreading outwards. Transit Oriented Development generally requires about seven residential units per acre in residential areas and twenty-five employees per acre in commercial centers to adequately justify transit ridership. Transit ridership is also affected by factors such as employment density and clustering, demographic mix (students, seniors and lower-income people tend to be heavy transit users), transit pricing and rider subsidies, and the quality of transit service. This type of development could potentially work well within Great Falls and its outlying areas as development occurs. Features could be built into a given development to encourage transit use from the start, and at the same time could be incorporated into the funding source available to the Great Falls Transit District to help offset costs associated with new service.

Alternating Directions of Travel Lanes

This method of TDM is similar to that of Traffic Calming in that it strives to change driver characteristics and possibly enable users of the system to try different modes of travel. It also can serve to relieve a corridor during particularly heavy times of the day.

4.2.1. Effectiveness of TDM Strategies

Measuring the effectiveness of TDM strategies can be done using several different methods such as cost, usage, or those listed below:

- Reduced traffic during commute times;
- Reduced or stable peak hour traffic volumes;
- Increased commuter traffic at off peak times;
- Increased use of modes other than single occupant vehicles;
- Increased use of designated routes during emergencies or special events;
- Eased use of the transportation system by tourists or others unfamiliar with the system;
- Reduced travel time during peak hours; and/or

- Fewer crashes during peak hours.

In order to provide a TDM system that will address the needs of the Great Falls area, the elements of the system must be acceptable to the general population. If elements are proposed which are not acceptable, the TDM system goals will not be reached. However, it is also important to keep in mind the cost of implementing TDM measures.

Table 1 presents available TDM measures and ranks them by the likeliness of being accepted and implemented within the Great Falls area. A rank of "3" indicates that the measure has a high likelihood of being successfully implemented, a rank of "2" indicates that the measure would have more difficulty being accepted or implemented and a rank of "1" indicates that this measure would either be difficult to implement, or is inappropriate for the community at this time. This ranking system is based on input from public meetings, as well as consultant knowledge and experience. It is not survey based.

The measures which could best be adopted and accepted by Great Falls area residents are those which allow greater flexibility in work hours, changing modes of transportation, or address specific, time-limited situations.

Those measures that would not be used in Great Falls generally address issues not present in Great Falls, such as significant commuting from a suburb. If such a problem existed, park and ride lots could be installed to address it. However, I-15 presently has less than one-third of the traffic that 10th Avenue South has and operates under free flow conditions at all times of the day. Other measures that would not be implemented in Great Falls in the foreseeable future involve "pay for parking" outside the downtown area. Travel characteristics in Montana are heavily dependent on population densities, distances to services (retail, medical, etc.), and locations of major employment centers.

Often times travel distances are longer than what would be encountered in a larger urban area. Due to this nature of travel in Montana, private automobiles are unlikely to be replaced by other modes of travel until a change in technology occurs which allows travel by a mode that has the same flexibility of the automobile.

Table 1: TDM Measures Ranked by Anticipated Usability

Rank	Strategy
1 - Difficult to implement / not applicable at this time.	Alternating directions of travel lanes
	Car sharing
	Express bus service
	Higher parking costs for single occupant vehicles
	Installing HOV lanes
	Mandatory TDM measures for large employers
	Park & Ride Lots
	Pay for parking at work sites (outside the downtown area)
	Preferential parking for rideshare / carpool / vanpools
	Vanpooling
2 - Some difficulty being accepted or implemented.	Bicycling
	Guaranteed ride home program
	Installing/ increasing ITS
	Ramp metering
	Required densification / mixed use elements for new developments
	Ride sharing (carpooling)
	Subsidized transit by employers
	Telecommuting
	Transit-Oriented Development
	Use of Transit
	Walking
3 - High likelihood of being successfully implemented.	Alternate work schedule
	Compressed work week
	Flextime
	Identifying routes for emergencies or special events
	Linked trips
	Traffic Calming

Another way to rank TDM measures is by the long-term cost effectiveness of the measure. The following **Table 2** ranks the potential TDM strategies by cost effectiveness. Cost effectiveness is defined as the greatest impact on managing traffic demand at the lowest cost to maintain / extend the transportation system. A rank of “3” indicates a measure which is the most cost effective, a rank of “2” indicates a measure which is moderately cost effective, a rank “1” measure is not cost effective, and the cost effectiveness of a rank “0” is unknown. This ranking system is based on input from public meetings, as well as consultant knowledge and experience. It is not survey based.

Efforts merely to make the general public aware of the TDM programs are ineffective. TDM strategies only succeed when people actually change their trip-making behavior. Trip-making behaviors could be changed with incentives. Marketing programs with incentives can successfully introduce people to new ways of making trips, but keeping these same patrons in the new system then depends on additional measures or a change in mindset.

Table 2: TDM Measures Ranked by Cost Effectiveness

Rank	Strategy
0 - Unknown	Alternating directions of travel lanes
	Identifying routes for emergencies or special events
	Required densification / mixed use elements for new developments
2 - Moderately cost effective	Alternate work schedule
	Car sharing
	Compressed work week
	Flextime
	Guaranteed ride home program
	Installing HOV lanes
	Linked trips
	Park & Ride Lots
	Ramp metering
	Ride sharing (carpooling)
	Subsidized transit by employers
	Telecommuting
	Traffic Calming
	Transit-Oriented Development
	Vanpooling
3 - Most cost effective	Bicycling
	Express bus service
	Higher parking costs for single occupant vehicles
	Installing / increasing ITS
	Mandatory TDM measures for large employers
	Pay for parking at work sites (outside the downtown area)
	Preferential parking for rideshare / carpool / vanpools
	Use of Great Falls Transit
	Walking

Pricing parking is among the most cost-effective alternatives. Taxes and/or charges for parking, however, are extremely unpopular with day-to-day users of the system, and are not recommended for Great Falls. However, these strategies are cost-effective since they can immediately change travel behavior and can be revenue neutral or generate revenue. In a highly congested, highly urbanized environment, this is a good option.

Another cost effective TDM alternative is using alternate modes of transportation such as transit, carpools, bicycling and walking. Many residential areas in Great Falls are within easy biking / walking distance of employment sites and shopping opportunities. Bus service is also readily available for most of Great Falls. The infrastructure for these alternatives is already in place and ready for use at any time.

Work week changes such as a compressed work week, alternate starting times, and telecommuting are among the most popular strategies with commuters, since they offer employees more time at home. They are less popular with employers since they may involve a change in the basic operating policies of the work site. Carpool and vanpool programs are less effective than changes to the work week unless there

are parking incentives and they are used consistently by employees. Additionally, managing these programs can be expensive and produce limited impact without supporting incentives and disincentives.

Improvements from transit service changes cannot be quickly realized. Transit users must adjust to the changes, and the true impacts of any changes to the transit system will not be realized for approximately one year. Therefore, these changes must be weighed carefully. They are disruptive to the users of the system, and even attempts to reinstate previous routes are disruptive from a user's standpoint.

While some early evidence suggests that transit, bicycle, or pedestrian related developments are effective in increasing the use of these modes at new residential, commercial, and office sites, the cost effectiveness of these strategies is still unknown. Providing these amenities with the installation of the original infrastructure can provide an aesthetically pleasing, highly desirable development to live and work in. One study in southern California showed that employers who combined financial incentives with an "aesthetically pleasing" site, exhibited trip reduction results that were ten percent higher than those without these two critical strategies.

Applying TDM strategies to non-commute trips can be problematic. In Great Falls, as elsewhere, commute trips (home-based work trips) account for fewer than 20 percent of all travel. Trips for shopping, school, recreational, or other purposes generally have higher auto occupancy rates than home-based work trips. Using nationwide averages, home-based work trips have an average occupancy of about 1.1 people per vehicle, whereas other trip types have an average occupancy of 1.4 to 1.5 people per vehicle. Note that in Great Falls there is a high proportion of school related trips that use transit. Over 40 percent of transit users are associated with the schools. Not all TDM measures will work for non-commute trips. An example of this is bicycling to the home improvement store. Items bought at a home improvement store are usually bulky and/or heavy. This makes it difficult to get them home.

Finally, the concept of "linked trips" within an area can be an effective means of limiting traffic on the transportation system. These trips are sometimes referred to as "shared" or "internal" trips. These trips are generated by associated facilities within a mixed-use development or within an area of the community where adjacent land uses are varied and offer services that would limit the need to travel large distances on the transportation system. An example would be a development that incorporates residences, office space, industrial space, retail space, a health club, etc. The vehicle operator in this case may live and work in the same development, therefore reducing the need to access the transportation system outside of the immediate area. Linked trips do not represent additional trips on the surrounding transportation system. Future developments that incorporate mixed uses and travel sharing within its limits should be encouraged through the planning function. This is especially desirable given the noted change in demographics that has occurred and is expected to continue occurring over the foreseeable future in the US and Montana.

4.2.2. Event Specific TDM Strategies

TDM strategies can be applied to specific events. If an event occurs on a regular basis which can be planned for, steps can be taken to manage the demands made on the transportation system. In Great Falls there are three events which would benefit from different types of management techniques.

The first is the 4th of July fireworks display. This event draws significant numbers of people in vehicles into the transportation corridors along the Missouri River, near the fireworks display. When the fireworks display ends, all of the vehicles attempt to leave the area at the same time. This causes significant congestion until the vehicles have cleared the area. The City of Great Falls has already adopted one TDM measure to address this situation, namely, providing specialized signal timing which allows the greatest opportunity for this traffic to disperse to their destinations. A second TDM measure which could be

considered would be temporarily modifying the traffic control at certain key locations. This would involve using flaggers to direct traffic and allow vehicles to proceed through intersections at the flaggers' direction rather than using traffic control normally in place. This would allow vehicles to get through these intersections in less time than would be possible without the flaggers' help.

The second event, which has been brought forward by members of the public during the public meetings, deals with exiting the Great Falls Voyagers parking lot after a game is over. Longtime residents of Great Falls remember when this lot had a second exit point which took traffic to the east along River Drive North. This exiting option is no longer available, and these people are frustrated by having to wait at the main entrance. The primary reason for closure of this exit was due to safety related concerns over left turning traffic out of the parking lot and potential crashes with the traffic stream on River Drive North. TDM measures can be put in place to facilitate vehicles exiting this parking lot.

The simplest one is again using flaggers to temporarily modify the traffic control at the exit point. This would allow left and right turning traffic to exit the parking lot in less time than it would otherwise take. Depending upon how the exiting traffic proceeds, a flagger may also be appropriate at the intersection of 25th Street North and River Drive North. Other modifications to the transportation system may also be appropriate depending upon where the traffic actually goes.

The third item which could be addressed using TDM measures is developing detour routes for accidents or other road blockages along the 10th Avenue South corridor (which includes Country Club Boulevard and I-315). Due to the amount of traffic on 10th Avenue South, developing plans ahead of time to plan detours would help manage the demands of the transportation system. Of particular concern is the I-315/Country Club Boulevard segment which has very few route alternatives. Additionally, 10th Avenue South from 2nd Street South to 32nd Street South would also benefit by having detour plans in place.

4.3. TDM Conclusions

Many TDM options are available for use in Great Falls. Existing infrastructure is in place to use alternative modes of transportation including transit, walking and bicycling. There are several major employers in Great Falls including the medical providers, refinery, City government, County government, Montana Air National Guard and Malmstrom Air Force Base who could be approached to implement work week adjustments (flex time, alternate work hours, compressed work week) that could make a noticeable difference to congestion. Designating a couple of prime parking spots for carpooling could increase its use among employees and provide positive recognition for those who carpool.

Developing strategies to manage the demand on the system generated by specific repeatable events such as baseball games or the 4th of July fireworks display would involve a one-time use of Great Falls staff time. Adjustments to these strategies could be made after seeing how they work. Coordination with the Police Department or other departments that would help implement these plans would then be needed on an intermittent basis. Implementing these strategies in Great Falls could be done quickly and would be obvious to the traveling public. As such, it would be easy to demonstrate a successful TDM program and build approval for implementing additional TDM strategies.

4.4. Recommended TDM Strategies

Based upon this general TDM evaluation, Great Falls is poised to implement a successful TDM program. The recommended strategies are listed below. These could be implemented in any order. Since the 2009 Transportation Plan, efforts have been made to expand and improve bicyclist access to River's Edge Trail.

- Encourage employers to provide alternate work schedules to their employees.
- Implement a guaranteed ride home program for transit users.
- Provide bike racks in the downtown area for bicycling commuters.
- Increase bicyclist access to River's Edge Trail for commuting purposes.
- Encourage walking as a commute choice.
- Encourage biking as a commute choice.
- Look at ways to increase transit ridership.
- Review access to the Great Falls Voyagers ballpark and develop a plan to manage traffic into and out of the ballpark.
- Consider factors such as land use/zoning issues when approving non-rural projects in the outlying areas.
- Use Intelligent Transportation Systems methods, where appropriate, to alert motorists of disruptions to the transportation system can be highly beneficial to transportation users and effective tools for managing transportation demands.

5.0 OTHER TRANSIT CONSIDERATIONS

Building upon the conclusions of the TDP, this section of the transit summary and considerations presents planning level guidance on bus stop placement and other elements.

5.1. Bus Stop Placement

Bus stop placement is an important factor to achieving the best performing transit system possible. Below is a list of factors that should be taken into consideration when deciding on where to locate bus stops.

- Spacing along the route
- Location of passenger traffic generators
- Operational effectiveness
- Safety
- Access to the stop including pathways leading to and from the stop
- Right-of-way
- Curb clearance

Table 3 gives a list of advantages and disadvantages for the location of the bus stop at intersections. **Figures 1-3** shows the minimum recommended distances required for a bus stop based on the location relative to the intersection. These minimum recommended distances assume that either a 40-foot bus, or a 60-foot articulated bus, is being used. For Great Falls, the 40-foot bus would be considered the appropriate design vehicle.

Table 3: Bus Stop Placement Advantages and Disadvantages

Bus Stop Location	Advantages	Disadvantages	Recommended When the Following Location Conditions Exist
NEARSIDE: Located immediately before an intersection	• Less potential conflict with traffic turning onto the bus route street from a side street. • The bus boarding door is close to the crosswalk. • Bus has intersection to merge into traffic. • Bus driver can see oncoming buses with transfer passengers.	• Potential conflicts with right turning traffic due to cars cutting in front of the bus. • The stopped bus obscures the sight distance of drivers and pedestrians entering from the right. • The stopped bus may block visibility of the stop signs or traffic signals. • At signalized intersections, may result in schedule delays.	• When traffic is heavier on the farside than on the approaching side of the intersection. • When pedestrian access and existing landing area conditions on the nearside are better than on the farside. • When street crossings and other pedestrian movements are safer when the bus stops on the nearside than the farside. • When the bus route goes straight through the intersection. • When adequate sight distance can be achieved at the intersection.
FARSIDE: Located immediately after an intersection	• Does not conflict with vehicles turning right. • Appropriate after the route has made a turn. • The stopped bus does not obscure sight distance to the left for vehicles entering or crossing from the side street. • At signalized intersections, buses can more easily re-enter traffic. • The stopped bus does not obscure traffic control devices or pedestrian movements at the intersection.	• The stopped bus obscures the sight distance to the right of drivers entering from the cross street to the right of the bus. • If the bus stopping area is of inadequate length, the rear of the stopped bus will block the cross street (especially an issue for stops where more than one bus may be stopped at a time). • If the bus stops in the travel lane, it may result in queued traffic behind it blocking the intersection.	• When traffic is heavier on the nearside than on the farside of the intersection. • At intersections where heavy left or right turns occur. • When pedestrian access and existing landing area conditions on the farside are better than on the nearside. • At intersections where traffic conditions and signal patterns may cause delays • At intersections with transit signal priority treatments.
MID-BLOCK: Located 300 feet or more beyond or before an intersection	• The stopped bus does not obstruct sight distances at an intersection. • May be closer to major activity centers than the nearest intersection. • Less conflicts between waiting and walking pedestrians.	• Requires most curb clearance of the three options (unless a mid-block sidewalk extension or bus bulb is built). • Encourages mid-block jaywalking. • May increase customer walking distances if the trip generator is close to an intersection. Length of mid-block stops can vary due to depth of a turn-out and a bus' ability to maneuver in/out of traffic lanes.	• When traffic or street/sidewalk conditions at the intersection are not conducive to a near-side or far-side stop. • When the passenger traffic generator is located in the middle of a long block. • When the interval between adjacent stops exceeds stop spacing standards for the area. • When a mid-block stop is compatible with a corridor or district plan.

Source: Omnitrans: Transit Design Guidelines Final Report (March 15, 2013)

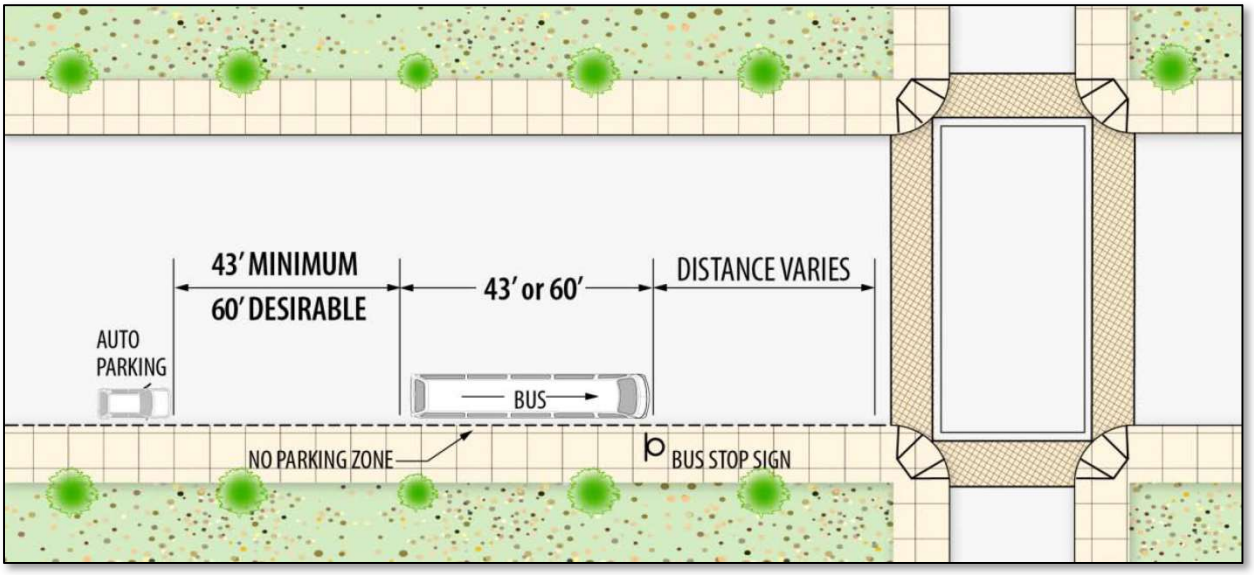


Figure 1: Suggested Bus Stop Distance for Nearside Locations

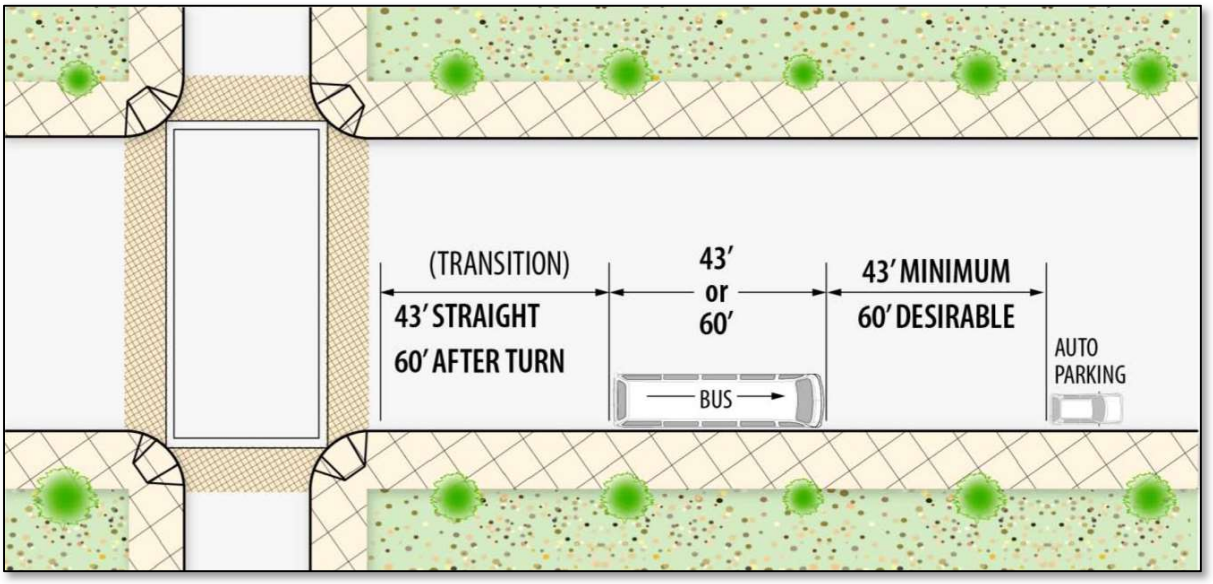


Figure 2: Suggested Bus Stop Distance for Farside Locations

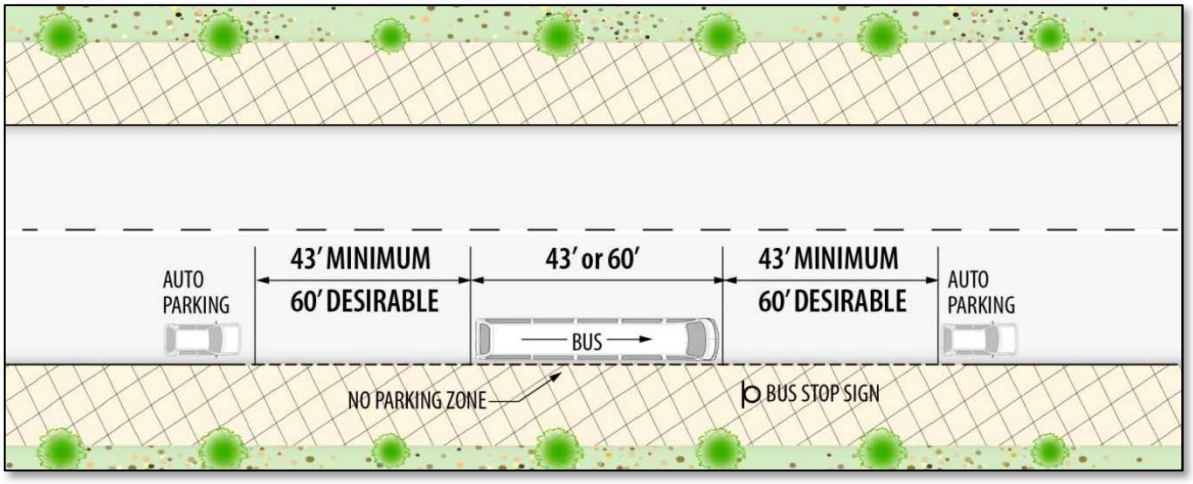


Figure 3: Suggested Bus Stop Distance for Mid-Block Locations

5.2. Bus Stop Elements

It is expected that each bus stop should incorporate a number of elements. A list of the minimum elements that each bus stop should have is listed below.

- Landing Area – The landing area must allow for lifts or ramps to be deployed on a suitable surface to permit a wheelchair to maneuver safely on and off the bus.
- Pedestrian Connections – A landing area of 5-feet wide by 8-feet long must be connected to a sidewalk of at least 4-feet wide.
- Curb Ramps – These shall be designed to conform to state and federal ADA standards.
- Signage – Appropriate signage must be used to mark the location of the bus stop. Route and schedule information should also be supplied at each bus stop.
- Safety and Security – Bus stops should not have hazardous conditions that could be potentially unsafe to users. The area should be well lit and free of obstacles.

Figures 4-6 show typical shelter characteristics at bus stops.

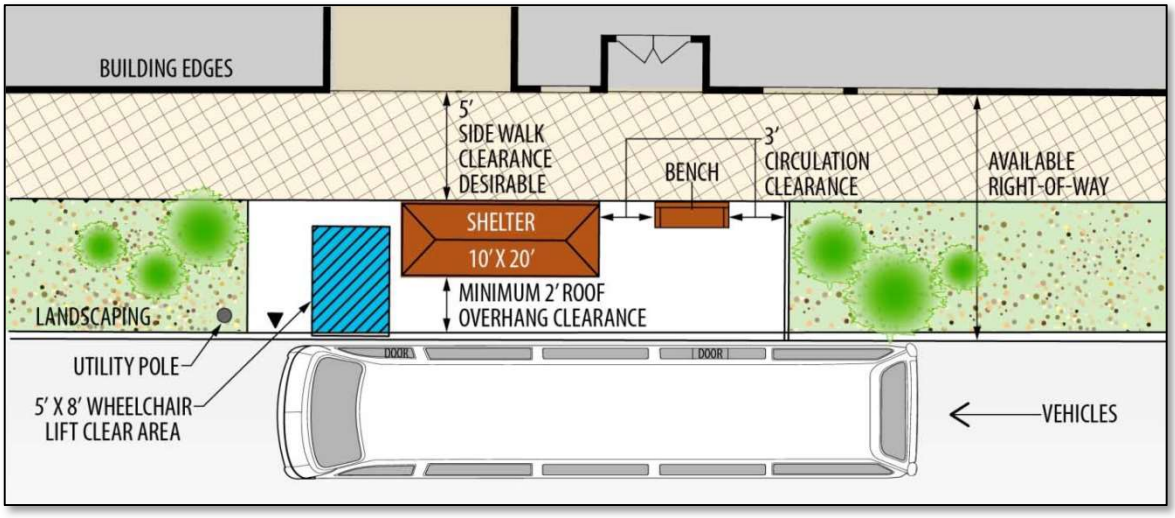


Figure 4: Typical Shelter Layout

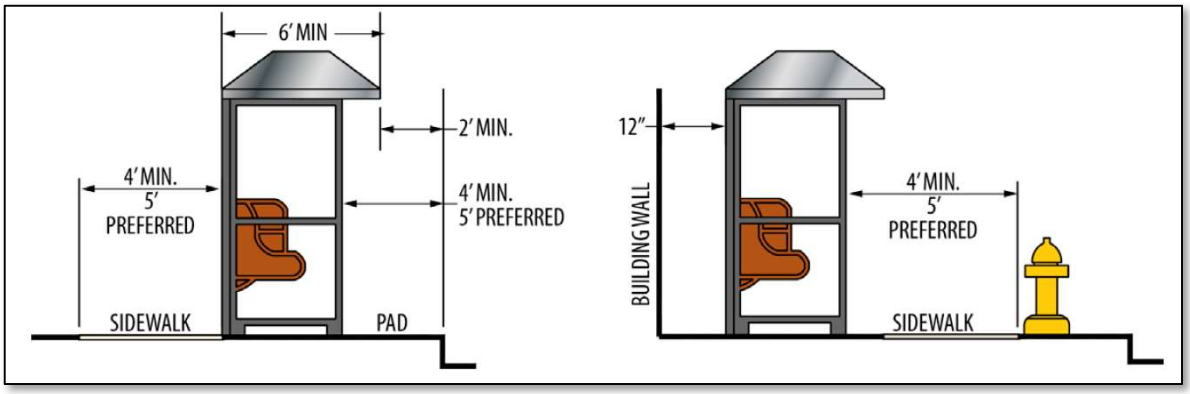


Figure 5: Typical Shelter Clearance

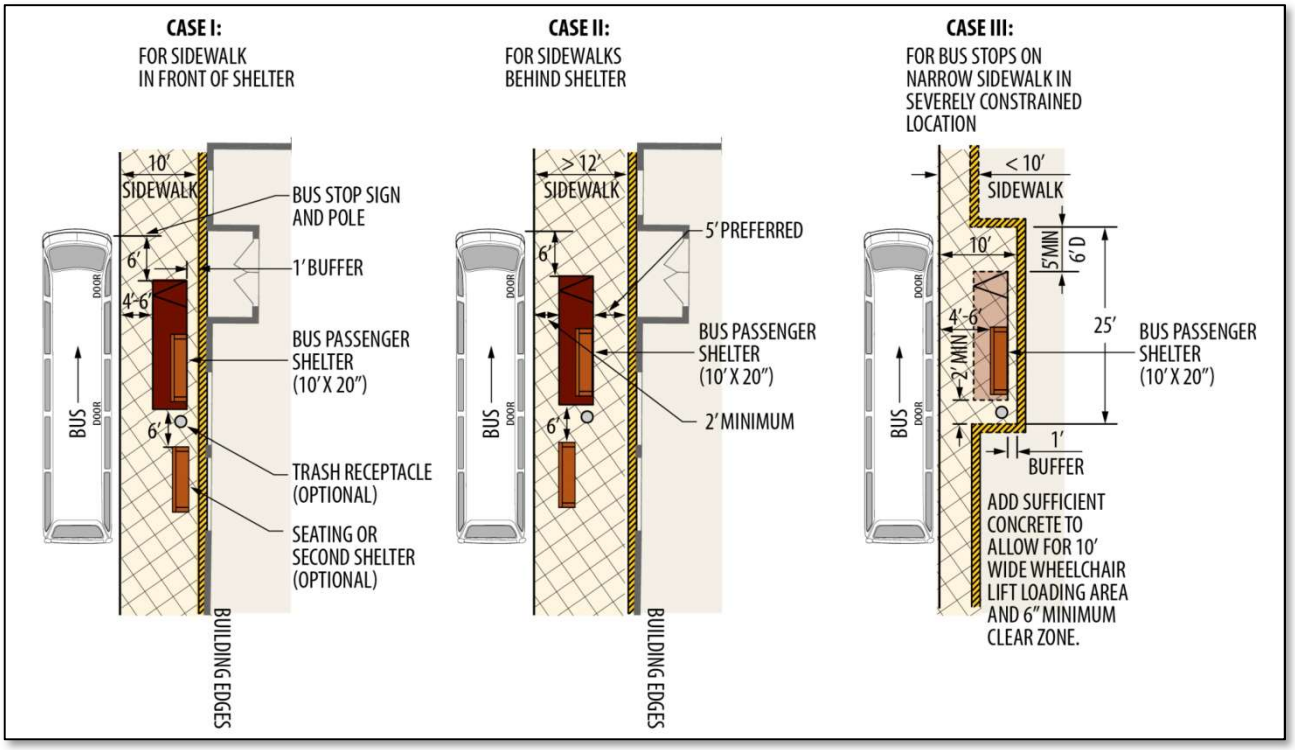


Figure 6: Typical Shelter Placement

6.0 TRAFFIC CALMING

Traffic calming refers to a number of methods used to reduce vehicle speeds, improve safety, and enhance the quality of life. In the simplest definition, it is changing the physical environment to reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for pedestrians and other non-motorized street users. Traffic-calming techniques are typically aimed at lowering vehicle speeds, decreasing truck volumes, and/or reducing the amount of cut-through traffic in a given area.

Some of the most universal goals of traffic calming are as follows:

- Reducing the frequency and severity of accidents.
- Addressing speeding or other problems on collectors or minor arterials.
- Improving the quality of life in residential areas.
- Reducing negative environmental impacts of traffic such as air and noise pollution.
- Promoting safe walking and bicycling.

Traffic calming measures can also have the following beneficial effects:

- Reduced need for police enforcement.
- Improved street environment (streetscaping/landscaping).
- Improved water infiltration into the ground.

Traffic calming techniques cannot be used with the same degree of success on all roadway facilities. Traffic calming is rarely seen on roadway facilities higher than a collector roadway functional classification. This is primarily due to roadways functionally classified higher than a collector having the

primary purpose of moving traffic, whereas for collector and local roadways the primary purpose tends to shift more towards serving adjacent land uses and infiltration into neighborhoods.

This section serves to delineate a process by which a traffic calming program can be carried out, as well as going further to discuss different traffic calming measures and their applicability to different transportation systems.

6.1. Purpose of Traffic Calming

Traffic calming is intended to reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users. It is used on local streets to discourage non-local traffic. Non-local traffic is not invested in the neighborhood, and therefore has less respect for speed limits, and the non- vehicular elements of the street environment. Certain, limited traffic calming measures are appropriate for slowing traffic on collectors or minor arterials as well.

Because traffic calming includes an educational or enforcement campaign, or an engineering study, it can result in the physical construction of traffic elements designed to reinforce the perceived need for caution by the users of the transportation system. The need for physical traffic calming devices indicates the transportation user's consistent failure to appropriately interact with the surroundings. Regardless of any traffic calming measures installed, the primary responsibility for safe use of the streets lies with the individual driver, cyclist, or pedestrian.

The success of traffic calming measures on a local street depends upon strong support by residents in the immediate area. Additionally, the traffic calming measures need to address situations that a number of residents agree should be addressed. Situations that many people agree exist and that could respond to traffic calming techniques will have more support from the neighborhood, and will better enhance the neighborhood environment. Traffic calming projects which involve installing "hard" improvements should meet several criteria before being considered for implementation, because they can be disruptive to the residents in the surrounding area, difficult to fund and maintain, and difficult to remove once installed.

Traffic calming elements can be incorporated into the initial design of subdivision, or can be retrofitted into existing subdivisions. The City of Great Falls has many streets which already contain traffic calming measures. These include street trees, on-street parking, and sidewalks separated from the street by a planting strip. Other techniques can include landscaped medians, pedestrian bulb-outs at corners, traffic circles or other intersection design techniques as well as other mid-block design techniques.

There are however, several circumstances where traffic calming becomes necessary. One of the most common circumstances is when the arterial system is congested or has turn restrictions. This set of circumstances may lead to arterial traffic detouring into an adjacent neighborhood. Local streets near a heavily used arterial can experience arterial traffic. In Great Falls, 9th Avenue South appears to experience this phenomenon due to its proximity to 10th Avenue South. To address this situation, stop signs have been installed at some locations. Installation of stop signs is one of a number of traffic calming measures, and has been used extensively by the City. Stop and yield signs are prevalent on the east/west legs of the intersections of 9th Avenue South with the various north/south streets. These serve to discourage through traffic, while still allowing local traffic and necessary circulation back to 10th Avenue South.

During street construction traffic calming issues may be raised. Detours are necessary but frustrating for residents. However, when motorists use alternate routes instead of the designated detours, concerns with congestion, speed, pollution and enforcement become real. But these issues are temporary, and

temporary measures are appropriate to address them. Some examples of temporary traffic calming measures include:

- Removable median curbs to constrict, or choke, a roadway;
- Removable median curbs placed to form a traffic circle within an intersection;
- Removable median curb placed to form forced turn diverters;
- Temporary bollards to close off traffic to a roadway; and
- Temporary speed bumps.

Very few traffic calming techniques are appropriate for use on arterials, because they interfere with an arterial's ability to move people and vehicles quickly from one place to another. The techniques which are appropriate for the arterial system are summarized later.

6.2. Types of Traffic Calming Measures

There are two forms of traffic calming, active and passive. Active measures are usually applied after a street has been constructed to correct a perceived problem with driver behavior. Passive measures are more likely to be included during the initial design of a roadway. Generally, active measures are not appropriate for the arterial network as they interfere with the purpose of arterials to move larger volumes of vehicles. However, appropriate use of passive measures may accomplish the purpose of encouraging safer driver, cyclist, or pedestrian behavior without restricting traffic flow. Arterials should be considered in any active traffic calming plan since speeding and cut-through traffic on local streets can be an indicator that the arterial network is not functioning properly. Therefore, improvements to the arterial network may be a more effective solution than active traffic calming on smaller streets.

Traffic calming measures generally fit into one of the following major categories:

- Passive measures;
- Education and enforcement;
- Signing and pavement marking;
- Deflection (either vertical deflection or horizontal deflection); and
- Diversions or restrictions.

6.2.1. Passive Measures

Passive measures are described as measures which are built into the street environment. They are not immediately obvious to the traveling public, but nevertheless produce a calming effect on traffic. Some of these measures are listed below.

- Tree-lined streets;
- Streets with boulevards separating the sidewalks;
- Streets with raised center medians (usually landscaped);
- On-street parking (including angled parking);
- Highly visible pedestrian crossings; and
- Short building set-back distances.

These elements tend to slow traffic by giving motorists the impression that the street is narrow and that extra care is required, but these elements do not restrict or interfere with traffic flow. A combination of more than one of these techniques, or these techniques combined with measures from the other categories, will produce better results.

6.2.2. Education and Enforcement

Several techniques are available to raise public awareness of traffic problems and change the behaviors contributing to problems. Some of these techniques are discussed in this section.

NEIGHBORHOOD SPEED WATCH PROGRAM

A speed monitoring program where residents themselves measure vehicle speeds with a radar unit and record license plate numbers of speeding vehicles. Follow-up action of the data can include sending letters to the registered owners of the vehicles explaining the safety concerns within the neighborhood and requesting better observance of the speed limits.

RADAR SPEED MONITORING TRAILER

A pull-behind trailer equipped with speed detection equipment, a readout of vehicle speeds, and a sign with the posted speed limit is brought to an area with speeding problems. The Great Falls Police Department currently has one of these trailers and this service can be requested by contacting the Great Falls Police Department. These trailers are usually unmanned; however better results are obtained if someone is present. Additionally, the trailer can be equipped with a camera that would record license plate information for possible follow-up.



Advantages

- Widely accepted
- Basically run themselves
- Can save data and be used to determine problem areas and times
- Works as a driver education method
- Portable

Disadvantages

- May require additional enforcement
- Can encourage speeding of some groups of drivers
- Vandalism may occur
- Limited effectiveness when not used in conjunction with additional enforcement

Special Considerations

- Signing
- Enforcement level
- Maintenance

Estimated Cost

- $10,000 to $20,000

NEIGHBORHOOD TRAFFIC SAFETY CAMPAIGN

As a part of the normal neighborhood group activities, newsletters or other materials can be produced containing educational information regarding traffic issues. These materials can be tailored to issues of specific concern to different neighborhoods. These issues can then be addressed at regularly scheduled meetings or at special meetings and recommendations can be put forward to increase neighborhood traffic safety.

TARGET ENFORCEMENT



This is a requested, time-limited addition of police enforcement within a neighborhood. Increasing the level of police enforcement on streets that are prone to speeding problems can be an effective way to reduce the number of speeding vehicles. Additional police enforcement can help to discourage drivers from breaking speed limit laws in the area. The speed reduction, however, usually is only reduced for a short period of time or as long as the enforcement is maintained. In order to have a long term effect on speeding, police enforcement must be on a repetitive non-routine basis while having signage and/or brochures in the area to indicate that enforcement will be increased in the area. There can be significant budget and manpower constraints to having continual police enforcement. Using police personnel to enforce speed limits is typically a low priority for police departments. The cost of enforcing speed limits on a continual basis can be unjustifiable.

Advantages

- Effective at slowing vehicle speeds down
- Widely accepted
- Increases safety level of the area

Disadvantages

- Requires continual enforcement
- Not of high priority to police departments
- Expensive

Special Considerations

- Signs
- Continual enforcement

Estimated Cost

- Varies

PUBLIC SERVICE ANNOUNCEMENTS (PSA'S)

The Great Falls Police Department regularly produces video public service announcements on traffic issues, mainly related to safety. These occasionally include traffic calming information, and are televised during local news programs. PSA's could be used more regularly to inform the public on traffic issues and calming techniques.

6.2.3. Signage and Pavement Marking

Traffic control signs and pavement markings can be installed as non-intrusive traffic calming measures. These techniques are already in use in the Great Falls area. The signs can include speed limit signs, dead-end street signs, and signs indicating school crossings or general pedestrian crossing. Pavement markings can include marked crosswalks, delineation of (narrow) lanes, and speed limit markings. Traffic calming techniques which specifically fall in this category include:

- **Truck Route Signing:** Signs placed on routes where trucks are allowed, plus signs placed on routes where trucks are not allowed.
- **Basket Weave Stop Sign Pattern:** Stop signs placed at every intersection in a residential neighborhood with stops alternating between east west and north south. Note: this is appropriate for local access streets only, and it disregards MUTCD warrants.
- **Speed Limit Signs:** Installing new or additional speed limit signs.
- **Edge Lines:** Painted lines on the pavement which narrow traffic lanes and/or provide for bicycle lanes or on-street parking.
- **Stop Bars:** Painted lines on the pavement that show motorists where to stop for stop signs.

DECREASED SPEED LIMITS



Decreasing speed limits in an area prone to speeding is a simple low cost approach to trying to deter drivers from breaking the speed limit. However, the posted speed limit is generally ignored by the driver. Drivers generally travel at speeds they consider reasonable and are often influenced by other drivers in the area. There is usually little to no effect on vehicle speeds by simply lowering the speed limit in the area. To have an effect on vehicles, the lower speed limits must be accompanied by other means of speed control. These other means could be increased law enforcement, speed bumps, or any other method that would help promote lower speeds in the area. Decreasing speed limits in areas such as school zones is common and does tend to have some effect on speeding. The effect can be much higher by using law enforcement to help monitor the area.

Advantages

- Low cost
- Useful when done in conjunction with other speed control methods
- Useful in areas such as school zones
- Disadvantages:
- Little to no effect on vehicle speeds when done alone
- Often times ignored
- Requires additional measures

Disadvantages

- None

Special Considerations

- Signs
- Enforcement
- Maintenance

Estimated Cost

- $4,000 to much higher depending on design

PAVEMENT MARKINGS



Pavement markings can be used for anything from on-street parking, to accentuating already existing features, to creating new features. Using pavement markings to indicate areas where on-street parking would occur creates a safer parking environment and also directs traffic in the area. A slight speed reduction may occur if the travel lanes are narrowed due to the markings. When pavement markings are used to accentuate already existing features, they can make the features look bigger and give advanced warning about them. Pavement markings can also be used to create turning lanes and to direct traffic flow without having to use expensive medians or curbs.

Pavement markings are generally not overly effective on vehicle speed reduction unless they create the impression of a narrowed roadway. While pavement markings don't force drivers to act, they do give them guidance on how to act.

Advantages

- Inexpensive
- Can accentuate already existing features
- Can help create areas of caution
- Gives guidance to the drives

Disadvantages

- Limited effect on vehicle speed reduction
- Must be maintained
- Not easily visible under snow or water

Special Considerations

- Maintenance
- Signage
- Visibility

Estimated Cost

- Varies

6.2.4. Deflection, Narrowing, Diversion, and Restriction

There is a wide variety of physical traffic calming measures which fall under the categories of vertical deflection, horizontal deflection and installation of diversions or restrictions. Each measure has both advantages and disadvantages.

Several guidelines should be considered when deciding to implement these types of measures. These include:

- Attempt less restrictive measures before considering more restrictive measures such as road closures or other route modifications.
- Space devices 300 to 500 feet apart in order to contain speeds to a 20 to 25 mile-per- hour speed range.
- Make accommodations for drainage and snow removal.
- Make accommodations for emergency vehicles.
- Consider pedestrian and bicyclist needs.
- Address landscaping or other maintenance issues.

Descriptions of a wide variety of physical traffic calming measures, as well as the advantages and disadvantages of each are presented on the following pages. A general magnitude cost range is shown for a basic installation of each measure. These costs can increase significantly with the addition of irrigation systems and street lighting, or the acquisition of right-of-way. Beautification amenities, such as brick pavers or extensive landscaping, can also dramatically impact project costs.

SPEED BUMPS, HUMPS, TABLES, AND CUSHIONS

Speed bumps, humps, tables, and cushions are all design features which are raised above the roadway. The differences between the four types are in their geometry. Speed bumps are the smallest and are generally 3 to 6 inches high and 1 to 3 feet long. They are typically used in parking lots and low speed residential areas. Speed bumps slow vehicles traveling at slow speeds down to approximately 5 miles per hour. Vehicles traveling at higher speeds may be impacted less by the bumps.

Speed humps are larger than speed bumps and range from 3 to 4 inches high and 10 to 14 feet long. They can be used on streets where a low speed limit is desired. Speed humps generally can slow vehicles down to approximately 15 miles per hour. If traveled over at higher speeds the vehicle will experience a severe jolting effect.

A speed table is a lengthened speed hump with a flat top. Speed tables are typically long enough so that the entire wheelbase of a car rests on the table. The design of speed tables allows for higher speeds than those of speed humps, but creates a smoother ride for larger vehicles. The height of speed tables is similar to speed humps, but the length can vary. A typical 22-foot long speed table has a design speed of approximately 30 miles per hour.



Speed cushions are a series of speed humps installed across the width of the roadway with spaces between them. The spaces are spaced so that emergency vehicles can pass between them without being affected by the bumps. Ordinary cars have smaller axels and will therefore need to travel over the bump with at least one side of their car. Speed cushions have about the same effect on slowing cars down as speed humps do while still allowing emergency vehicles to be unaffected by them.



These traffic calming measures can be placed at spaces ranging from 250 feet to 800 feet to gain a continuous effect on slowing vehicle speeds. If they are placed at distances greater than 800 feet, there is enough room between them for driver to speed up between the devices which will limit their effectiveness.

Advantages

- Slows traffic down
- Increases safety levels
- Decreases traffic volume
- Self-enforcing
- Relatively inexpensive

Disadvantages

- May promote speeding between them
- May increase volume on other streets
- Difficult to properly construct
- May alter storm drainage flow
- May interfere with snow and ice control measures

Special Considerations

- Emergency vehicles
- Drainage
- Signage
- Snow Removal

Estimated Cost

- $1,000 to $8,000

RAISED INTERSECTIONS

Raised intersections are flat raised areas around the intersection with ramps attaching each approach to the intersection. The ramps and/or the intersection can be made out of a textured or painted material to make them stand out visually. By raising the level of the intersection and the cross walks, the area becomes more noticeable to the driver. This creates a safer environment for pedestrians crossing at the intersection. Raised intersections are ideal in areas with heavy pedestrian traffic and on-street parking that doesn't allow for other measures to be taken.



Advantages

- Improved safety for vehicles and pedestrians
- Can be visually appealing
- They work for the entire intersection, not just one street
- Better for emergency vehicles than speed humps

Disadvantages

- Increases turning difficulty
- Increased maintenance
- Requires additional signage
- Less effective at reducing speeds than speed humps and speed tables
- Can be expensive depending on the materials used
- May alter storm drainage flow
- May interfere with snow and ice control measures

Special Considerations

- Emergency vehicles
- Drainage
- Signage
- Snow Removal

Estimated Cost

- $4,000 to $12,500 depending on materials used and size of intersection

RAISED CROSSWALKS

Raised crosswalks are simply speed tables that have crosswalk signage and markings to allow for pedestrians to cross the roadway. The raised level of the crosswalk makes it more visible to the driver and therefore safer for the pedestrians. Raised crosswalks are ideal in locations where there is heavy pedestrian traffic and high vehicle speeds. Raised crosswalks have the advantage of slowing vehicles down who drive over them and alerting vehicles to possible pedestrian traffic in the area.



Advantages

Disadvantages

- Improved safety for vehicles and pedestrians
- Can be visually appealing
- Effective at reducing vehicle speeds
- Makes the crosswalk and pedestrians more visible

- May promote speeding between them
- Difficult to properly construct
- May slow down emergency vehicles
- May alter storm drainage flow
- May interfere with snow and ice control measures

Special Considerations

- Emergency vehicles
- Drainage
- Signage
- Snow Removal

Estimated Cost

- $2,500 to $8,000

TEXTURED PAVEMENT



Textured pavement can be created by either stamping the pavement or by using an alternative material like brick or cobblestone. The purpose of both methods is to create a surface that is unpleasant to drive over at high speeds due to the uneven texture of the surface. If driven over at higher speeds the texture will cause a noticeable vibration to the car, much like a rumble strip does. The variation in the surface will also cause an audible difference when driven over. Generally, the pavement area that is textured is either painted a different color or the materials used are of a different color. The change in color makes the area standout visually and will alert the driver that caution needs to be taken in the area. Warning signs can also be used in conjunction with the textured pavement to increase their effectiveness. Textured pavement can also be used to highlight crosswalks or other areas of interest.

Advantages

- Can reduce vehicle speeds
- Can increase driver awareness
- Provide visual and physical warnings to the driver
- Can be used to highlight most areas
- Aesthetically pleasing if properly designed

Disadvantages

- May be difficult for pedestrians and bicyclists
- Can be very expensive depending on material and area covered
- Can add additional noise to the area
- Maintenance issues may arise

Special Considerations

- Emergency vehicles
- Drainage
- Signage
- Snow Removal

Estimated Cost

- Varies by design

SURFACE VALLEY GUTTERS

Valley gutters are dips in the street that can be used to carry runoff as well as cause discomfort to drivers at high speeds.



Advantages

- Effective if used in series at 300 to 500 foot intervals
- Self-enforcing
- Relatively inexpensive during initial construction

Disadvantages

- Drivers may speed up between dips
- May divert traffic and increase volumes on other streets
- Not usually appropriate for existing streets with established drainage patterns

Special Considerations

- Emergency vehicles
- Drainage
- Signage

Estimated Cost

- $1,000 to $2,000

TRANSVERSE RUMBLE STRIPS

Rumble strips are patterned sections of rough pavement in the street designed to slow traffic. The vibration caused by driving over the rumble strips is intended to cause motorists to slow down. The rumble strip provides visual and audio cues to alert drivers to areas that require special care (shopping centers, schools, entrances to residential neighborhoods). Changes in pavement color and texture (such as bricks or blocks), used in interesting and visually attractive ways, can also have the effect of rumble strips.



Advantages

- Create driver awareness
- Relatively inexpensive to install

Disadvantages

- High maintenance
- May adversely impact bicyclists
- Noisy by design, not recommended for all areas

Special Considerations

- Emergency vehicles

Estimated Cost

- $1,000 to $2,000

GATEWAY



A gateway is an entry treatment to the roadway or surrounding area that creates a sense of passage or change in traffic conditions to the area. Gateways can consist of vertical elements such as posts, trees, bushes, signs, poles, or columns. They can also be formed using curb extensions, changes in pavement color or type, or any other method that creates a sense of entry into an area. Gateways can cause a small reduction in traffic volume because they can make drivers feel uncomfortable about entering the area. A slight speed reduction can also be achieved through the use of narrowing the roadway at the gateway. Safety levels in the area may be increased as well since attention would be drawn to the area.

Advantages

- May slow vehicle speeds
- Highlights the intersection
- Increased pedestrian safety
- Aesthetically pleasing
- Does not inhibit emergency vehicles
- Possible small volume reduction

Disadvantages

- Increased maintenance
- May have limited effect
- Can increase the difficulty level to maneuver the area
- Can be very expensive

Special Considerations

- Lighting
- Signage
- Drainage
- Maintenance

Estimated Cost

- $4,000 to much higher depending on design

CHOKERS, NARROWINGS, SLOW OR ANGLE POINTS, NECKDOWNS, BULB-OUTS

Chokers are curb extensions that narrow a street, effectively creating a pinch point along the street. Chokers can be created by bringing both curbs in, or they can be done by more dramatically widening one side at a midblock location. They can also be used at intersections, creating a gateway effect when entering a street.



Chokers typically narrow the street to two narrow lanes or one lane at selected points and force motorists to slow down to maneuver between them. Curb extensions at midblock or intersection corners that narrow a street by extending the sidewalk or widening the planting strip. At midblock locations, this feature is sometimes referred to as parallel chokers, angled chokers, twisted chokers, angle or pinch points, slow points, or midblock narrowings. At intersections, the feature may be called a neckdown, bulb-out, knuckle, or corner bulge. Chokers are good for areas with substantial speed problems and no on-street parking shortage.



Advantages

- Minor inconvenience to drivers and local traffic
- May create on-street parking bays
- Shorter crossing distance for pedestrians
- Provides space for landscaping, can be aesthetically pleasing
- Can be used in multiple applications along roadway

Special Considerations

- Lighting
- Signage
- Irrigation and maintenance of landscaping
- Emergency vehicle access

Disadvantages

- May create opportunities for head-on conflicts on narrow streets
- Cost is greater that many other devices
- May lose some on-street parking near feature
- Unfriendly to bicyclists unless designed to accommodate them
- Can be very expensive

Estimated Cost

- $8,000 to $50,000 or higher depending on design

CHICANES

Chicanes are offset curb extensions that cause a deviation in the path of travel. They typically alternate from one side of the street to the other, forming S-shaped curves. Chicanes can also be created by shifting parking, either diagonal or parallel, from one side of the street and the other.



Shifting a travel lane influences speeds as long as the taper is not so gradual that motorists can maintain speeds. For traffic calming, the taper lengths should reflect the desired speed which should be posted prior to the chicane.

Advantages

- Imposes minimal inconvenience on local traffic
- Reduces pedestrian crossing distance
- Provides large area for landscaping
- Reduces speeds without significantly increasing emergency response times

Special Considerations

- Lighting
- Signage
- Irrigation and maintenance of landscaping

Disadvantages

- May create opportunities for head-on conflicts on narrow streets
- Cost is greater that many other devices
- Unfriendly to bicyclists unless designed to accommodate them

Estimated Cost

- $20,000 to $30,000

TRAFFIC CIRCLES



Traffic circles are raised circular islands placed in the center of the intersection about which drivers must navigate around. They cause vehicles to slow down through the intersection because they are forced to make turning movements. They are very effective at slowing vehicle speeds down. Pedestrian safety is also increased due to the decrease in speeds. Large vehicles may have trouble navigating around the traffic circles, especially when making left-hand turns. Traffic circles work well for low volume intersections where speeding is a common problem. Traffic circles are not to be confused with roundabouts, which exhibit large splitter islands, yield signs at each entry way, and are intended for larger intersections with higher traffic volumes.

Advantages

- Reduces crashes over stop control
- Provides space for landscaping
- Provides equal access to intersection for all drivers
- Provides good environment for bicyclists

Disadvantages

- May be restrictive for larger vehicles if designed to a low speed.
- Right-of-way may need to be purchased
- Initial safety issues as drivers adjust
- May increase volume on adjacent streets

Special Considerations

- Lighting
- Signage
- Irrigation and maintenance of landscaping

Estimated Cost

- $10,000 to $50,000 or higher depending on design and location

HALF CLOSURES



Half closures are put in place to block a single lane of traffic. They can be used to prevent vehicles from entering a road but still allow vehicles to exit the road. This is an effective means of limiting traffic on a roadway and also limiting turns off of the intersecting roadway. Half closures are generally made by extending the curb or placing a barrier to block entry. Ample signage must be put into place to alert drivers to the partial closure. Half closures are commonly used in areas where a residential road is experiencing heavy amounts of traffic due to its connection to a main road. Most of this traffic can be attributed to cut-through traffic and can be significantly decreased through the use of half closures.

Advantages

- Reduces access for residents or businesses
- May increase trip length
- Increases volumes on other streets
- Drivers may be able to drive around the barrier

Disadvantages

- Reduces access for residents or businesses
- May increase trip length
- Increases volumes on other streets
- Drivers may be able to drive around the barrier

Special Considerations

- Emergency vehicles
- Signage
- Maintenance

Estimated Cost

- $10,000 to $40,000

DIAGONAL DIVERTERS



Diagonal Diverters consist of a barrier being placed diagonally across a four-legged intersection which interrupts the traffic flow across the intersection. The traffic is diverted away from and is not allowed to drive straight through the intersection. The diverter gets rid of conflict points caused by thru traffic and turning movements within the intersection. They also discourage non-local traffic flow in the area, but still allow for local traffic. This method is effective in areas where there are problems with cut through traffic. The diverter needs to be visible enough to alert the driver to slow down and make the turn.

Advantages

- Eliminates through traffic and reduces traffic volumes
- Not a full road closure
- Provides space for landscaping
- Reduces traffic conflict points
- Increases pedestrian safety
- Can include bicycle path connection

Disadvantages

- May be an inconvenience to area businesses or residents
- May inhibit emergency vehicles
- Can be expensive if done as a retrofit
- Cause circuitous routes

Special Considerations

- Emergency vehicle access
- Lighting
- Signage
- Drainage
- Maintenance

Estimated Cost

- $10,000 to $80,000

FULL CLOSURES



Full street closures are created by placing barriers at an existing intersection. The full closures can be done to create a dead end or a cul-de-sac style road. An opening or trail can be placed to connect pedestrians and bicycles to the abutting road. The type of barrier used to create the closures can range from a bollard style to a full landscaped closure. A landscaped style is more aesthetically pleasing to the area, but is also much more expensive then placing bollards to stop vehicle traffic. Another method commonly used to create road closures is installing curb extensions to the roadway.

Road closures are very effective at lowering traffic volumes on the roadway. Cut through traffic can be greatly reduced through the use of full closure. It is common to use full closures to limit the amount of traffic on a residential street that was connected to a main street. By closing the connection to the main street, the traffic that previously used the residential street to connect to the main street would diminish thereby decreasing the overall traffic on that road. This does, however, create more traffic on other roads in the area since those vehicles would still have to access the main street via another street.

Advantages

- Eliminates through traffic
- Improves safety for all street users
- Can still have pedestrian and bicycle access
- Can be aesthetically pleasing

Disadvantages

- Reduces emergency vehicle access
- Reduces access to properties
- May increase trip lengths
- Increases volumes on other streets
- Can be expensive

Special Considerations

- Emergency vehicles
- Signage
- Drainage
- Maintenance

Estimated Cost

- $15,000 to much higher depending on design

MEDIAN BARRIERS



Median barriers are put in place in the middle of intersections to restrict cut-through movements at a cross street. They also restrict left-turns onto the cross streets from the main street. Putting a median barrier in place will reduce the number of conflict points and therefore increase the safety of the intersection. The barrier can be used as a pedestrian refuge for people wanting to cross the main street. This, along with the reduction in left-turns, increases pedestrian safety at the intersection. Median barriers also reduce traffic volumes on the side streets while increasing the traffic flow on the major street since there will no longer be vehicles sopping to take left-turns at the intersection. This type of barrier can work well in areas where the side street has turned into a popular cut-through street or in areas where there are problems with people stopping to make left-turns. The median barrier does restrict all vehicles, including emergency vehicles. However, the barrier can be designed so that emergency vehicles can travel around them if needed.

Advantages

- Lowers traffic volumes on the side street
- Provides space for landscaping
- Reduces traffic conflict points and increases safety
- Increases pedestrian safety

Disadvantages

- May be an inconvenience to area businesses or residents
- May inhibit emergency vehicles
- Require additional street width on the major street

Special Considerations

- Emergency vehicle access
- Lighting
- Signage
- Drainage
- Maintenance

Estimated Cost

- $15,000 to $20,000 per 100 feet

FORCED TURN ISLANDS



Forced turn islands are small traffic islands placed at intersections to restrict and channelize turning movements. They are generally put in place to block left-turn and through movements while still allowing for right-turn movements. This method is commonly used where smaller side streets intersect with a larger major street. Heavy left-turn or through traffic off of side streets can cause safety and traffic problems for the area. Restricting the movements from the side streets can increase the safety and traffic levels of the intersection. Forced turn islands are common place for parking lots or similar areas that have multiple entrances and exits. The islands encourage people wanting to turn left or go straight out of the area to use the designated intersections that don't have the forced turn islands; the designated intersections are generally larger safer intersections.

Advantages

- Provides space for landscaping
- Reduces traffic conflict points and increases safety
- May reduce cut through traffic
- Causes vehicles to use designated intersections

Disadvantages

- May be an inconvenience to area businesses or residents
- Driver may be able to maneuver around the island
- Diverts traffic to other roads
- May inhibit emergency vehicles

Special Considerations

- Emergency vehicle access
- Lighting
- Signage
- Maintenance

Estimated Cost

- $4,000 to $8,000

6.3. TRAFFIC CALMING PROGRAM FOR EXISTING STREETS

The method to implement a traffic calming program for existing streets is recommended in this section of the Chapter. It is important to note when examining this recommended program and its procedures that the process may be modified depending upon various factors. Some of these factors would include the severity of the problem, location of the problem (one intersection or area-wide), cause of the problem (such as a special seasonal event like the State Fair), or other circumstances which affect the situation

under consideration. Under any of these circumstances, the process may be altered at the discretion of the Public Works Department. This can include accelerating, slowing down, or terminating the process. Although some traffic calming measures are applicable to higher volume roads like collectors or in some commercial areas, the process outlined here is for local residential streets only.

To facilitate this process, the City will work closely with the Neighborhood Councils. This process would start early with the City supplying all the Neighborhood Councils with information about the traffic calming program and a number of Investigation Request Forms. With this preliminary coordination in place, the process can proceed smoothly.

PHASE I – PROBLEM IDENTIFICATION AND INVESTIGATION

Step 1: Step one can begin in two ways. First, a citizen contacts the Neighborhood Council where the traffic problem is. The Neighborhood Council listens to the circumstances, agrees there is a problem, and then completes an Investigation Request form and sends it to the Public Works Department. The responsibility to fill out the form can be delegated to the resident bringing forward the concern, or remain with the Council; or Second, the Neighborhood Council sees a need for traffic calming within their neighborhood on an area-wide basis and then completes and forwards an Investigation Request form to the Public Works Department.

The form is key to this process, because it has the information about the nature of the problem, its location, and the signatures of at least ten other neighborhood residents who agree the problem exists. Furthermore, it identifies the Neighborhood Council and interested local residents. Note the Investigation Request form requires signatures from ten residents agreeing that the situation observed exists, and this portion must be completed in order to move this process forward.

Step 2: After receiving the form, the Public Works Department would contact the neighborhood to discuss the nature of the perceived problem. This contact would include the Neighborhood Council and, if appropriate, local residents. This is an important step, since this discussion helps determine the types of studies which need to be conducted, and would help focus on potential solutions.

Step 3: The Public Works Department conducts a field review of the location, and collects the appropriate data in order to determine whether or not the perceived problem actually exists. For most requests, the accident records would be reviewed, and traffic volumes collected. Other studies that may be appropriate include a speed study, truck count, or determining the percentage of cut-through traffic.

Once this data is collected, it is reviewed in the office against baseline traffic calming criteria. These should include at least one of the following:

- Traffic volumes higher than 1,000 vehicles per day or 100 vehicles in one hour.
- Three or more accidents in a 12-month period, occurring within the last three years.
- An 85th percentile speed at least 5 mph over the speed limit.
- Truck traffic volumes exceeding five percent of the total traffic volumes.
- More than 25% cut-through traffic during any single hour of an average day.
- Pedestrian crossing volume of 25 people per hour for any single hour of an average day.
- Chronic failure of drivers to yield to pedestrian traffic at an intersection.
- Other criteria as agreed upon by the neighborhood and the Public Works Department.

After the data is collected and reviewed against the baseline criteria, the Public Works Department shares the results of the review with the Neighborhood Council and any interested local residents. If

the subject location meets the required criteria, the Public Works Department would review the Phase II process with the Neighborhood Council and interested local residents. If the location does not meet the above criteria, the Public Works Department would discuss options with the neighborhood to address the situation outside of the traffic calming program.

PHASE II – IMPLEMENTATION OF PASSIVE TRAFFIC CALMING STRATEGIES

Step 4: The Public Works Department determines the boundaries of the affected neighborhood. Neighborhood boundaries will generally follow arterial streets or other natural physical boundaries such as rivers, abrupt changes in elevation, etc. A neighborhood meeting would then be scheduled by the Public Works Department to discuss possible educational / enforcement solutions to the problem. The map prepared by the Public Works Department delineating the boundary of the affected neighborhood is given to the Neighborhood Council who is then responsible for contacting the area residents about the meeting. At the meeting, the Public Works Department would present a range of educational / enforcement or low level engineering options. These measures would emphasize the least intrusive measures which may expand beyond educational / enforcement options to only minor physical changes, such as increased signing, installing pavement marking or trimming vegetation. The purpose of this meeting is to agree on a course of action to address the situation. This step may require more than one meeting and should not be considered complete until a course of action is agreed upon.

Step 5: A member of the Neighborhood Council or interested local resident circulates a Phase II petition within the boundary of the affected neighborhood. This petition identifies the proposed education / enforcement / engineering techniques, and asks residents to indicate their approval. The petition must be signed by more than forty percent of the property owners within the boundary of the affected neighborhood for the process to proceed. If a large number of residences are not owner occupied, then neighborhood residents may sign the petition, but the required amount is raised to fifty percent. Because these measures affect residents at their homes and in their neighborhoods, substantial neighborhood support is mandatory. If the required amount of signatures are obtained, the identified measures can then be implemented. If neighborhood approval cannot be secured, no further action would be taken.

Step 6: Approximately 90 days after implementing the measures, the City would repeat the data collection process it performed in Phase I. Please note that the 90-day time frame is generally enough time for shifts in the traffic patterns to have occurred. However, this may need to be modified depending on seasonal conditions or other factors. If the data collected indicates that the problem has been alleviated, the educational and/or enforcement activities can be considered as adequate and the process a success.

PHASE III – IMPLEMENTATION OF ACTIVE TRAFFIC CALMING STRATEGIES

Step 7: If the traffic problem has not been resolved by the measures implemented during Phase II, the Public Works Department then conducts a more intensive engineering study to determine a range of appropriate physical improvements to the location. The study should consider installation of either vertical or horizontal deflection techniques before considering roadway obstruction techniques.

Step 8: The Public Works Departments schedules a neighborhood meeting to review the improvement options. Once again, the Neighborhood Council is responsible for notifying area residents about the meeting. The Public Works Department facilitates this meeting. Based on resident input, a preferred solution is selected from the range of possible solutions. If a temporary version of this traffic calming device is not practical, proceed to Step 11.

Step 9: If a temporary version of the device is feasible, the Neighborhood Council or a designated representative circulates a Phase III Petition for Temporary Measures throughout the affected neighborhood. At least fifty percent of the property owners within the affected neighborhood must sign the petition for the temporary version of the preferred traffic calming device to be installed. Once again, if the neighborhood is predominantly not owner occupied, the residents can sign the petition, but at least sixty percent of the residents must sign the petition. If less than fifty percent of the property owners or sixty percent of the residents sign the petition, the elements from Phase II may remain in place, but no additional elements would be installed.

Step 10: After one year, the City would repeat the same data collection process as completed during Phase I to determine whether or not the temporary device is effective. If it is found not to be effective, the City would notify the Neighborhood Council and remove the device. The process then can begin again at Step 7.

Step 11: If the temporary device is effective, the Public Works Department then develops a preliminary design and cost estimate for installing a permanent traffic calming device. The Public Works Department also determines the funding mechanism to finance the permanent solution. The Public Works Department would look at all possible funding sources including federal or state grants, pilot project funding, etc to lower the costs to local residents. The City would provide the Neighborhood Council with this information, and the "Petition for Installation of Permanent Measures" can be initiated.

Step 12: The Neighborhood Contact circulates the petition for Installation of Permanent Measures, which includes a copy of the preliminary design, the cost estimate and an explanation of financial responsibility to the property owners in the affected neighborhood. The petition must be signed by seventy percent of the property owners in the affected neighborhood to allow the process to move forward. If less than seventy percent of the property owner sign the petition, the process cannot continue, and the temporary measures would be removed. However, if more than seventy percent of the property owners sign the petition, the Public Works Department would bring this measure before the City Commission for their approval, complete a final design and arrange for construction of the permanent traffic calming device. Note that financial obligations by the residents would be required at this point and must be in place before construction would begin.

Note: there are numerous points during this process at which the traffic calming process can be ended due to completion of the process or lack of adequate neighborhood support. Since neighborhood sentiment can change at a later date, the process can be resumed a year later at the same step where it left off.

PROJECT COSTS

The cost sharing related to installing traffic calming measures should be based on the initial need for the measure. The need for the measures can arise from one of the following situations.

- Poor initial street design
- Inadequacies of the major street network
- Commercial and/or residential development adjacent to the neighborhood

During Phase I of the process, the nature and cause of the traffic problem would be identified. From this information, the City would proportion the project costs. It is possible that such entities as the City, the neighborhood residents, developers, or other parties would be involved in paying for the traffic calming measures.

The costs of Steps 1 through 11 would be mostly borne by the City, other than the volunteer hours worked to complete paperwork, gather petition signatures, and notify residents of traffic meetings. Permanent traffic calming measures, as proposed in Phase III (Step 12) would likely be financed by neighborhood contributions, development fees, City funds and funds from other sources. The proportion of funding from these sources will vary on a case-by-case basis.

Removal of Permanent Traffic Calming Devices

To remove a permanent traffic calming device, the Neighborhood Contact must submit a "Petition for Removal of Traffic Calming Measure". This petition must be signed by ninety percent of the property owners within the affected neighborhood. The property owners within the affected neighborhood will be fully responsible for paying the cost of removing the traffic calming devices.

6.4. Incorporating Traffic Calming in New Street Designs

Much more is known about street function and design now than was known when Great Falls was originally established and developed. As such, street function should be identified at the beginning of the project approval process, and the streets designed to accomplish the functions appropriate for them. Those designed as arterials (part of the major street network) should be designed to efficiently move traffic in a convenient and safe manner. Conversely, streets that are intended to be local access streets or collector streets should be laid out and designed to primarily provide access to adjacent land, while discouraging through traffic and the higher travel speeds that accompany it. New developments, therefore, should include inherent traffic calming features which are an integral part of their design. If designed properly, the appropriate functions of the different categories of street would be intuitively obvious to the traveling public.

Some of the techniques that could be adopted for local access streets include:

- Street layout;
- Design standards including: lane width, curve tightness, on-street parking and landscaping;
- Street connectivity;
- Pedestrian / bicycle facilities;
- Intersection treatments such as small corner radii, pedestrian bulb-outs, etc.;
- Judicious use of "T" intersections;
- Entrance treatment; and
- Roundabouts or Traffic circles.

To achieve these goals, the City could incorporate traffic calming improvements into the adopted standard street designs. These designs could include recommendations where various treatments are appropriate as well as when they could be used. Design details could also be included to provide a guideline of what would be acceptable to the City.

Traffic calming design characteristics should also be incorporated into the City's development review and annexation review processes. Proposed developments or requests to annex would be reviewed by staff to determine whether or not traffic calming elements incorporated into the development's layout are appropriate for the given location, or alternatively, what strategies are best suited, and what design details could be considered. The process should be designed to pro-actively assist developers in utilizing traffic calming strategies to improve the quality of life in their developments, while minimizing or eliminating the costs for retrofit efforts. Due to the long-term effects of original roadway layout and construction, the traffic calming program should apply to all development in the transportation study area.

The designing of new subdivisions with inherent traffic calming procedures in place will ultimately result in better neighborhoods for new residents, and better use of arterials by the traveling public.

6.5. Traffic Calming Techniques Applicable to Collectors and Minor Arterials

A few of the measures depicted on the tables on the following pages are applicable to non-local street conditions. Installation of any of these measures will be done at the discretion of City staff. These measures do not fall under the process outlined previously. The measures are restricted to horizontal deflection and include the following:

- Mid-block median;
- Curb bulb-outs / neckdown; and
- On-street parking.

These measures can be used to slow traffic where chronic speeding problems have been shown to exist, or to accommodate pedestrian traffic. The mid-block median usually is present on arterials due to another piece of infrastructure, such as a railroad track which passes over the street, or an overhead pedestrian crossing structure.

On-street parking almost always occurs in a residential area, but also can occur in retail or industrial sectors. Judicious use of on-street parking can influence the traffic flow and help regulate traffic speeds on collectors or minor arterials. Bulb-outs, also called neckdowns, can be used to create the illusion for the driver that the roadway is narrowing. This perception will cause the driver to slow down. A secondary benefit of the bulb-outs is the decreased walking distance for pedestrians at the crosswalks. Bulb outs generally are wide enough for a car to park in their “shadow”. This generally creates good separation between the parked cars and the moving traffic.

7.0 CONTEXT SENSITIVE SOLUTIONS

Context Sensitive Solutions (CSS) are an interdisciplinary approach that seeks effective, multi-modal transportation solutions by working with stakeholders to develop, build and maintain cost-effective transportation facilities which fit into and reflect the project’s surroundings – its “context.” With respect to transportation projects, context can be defined as “all elements related to the people and place where a project is located.” This includes both visible elements such as environmental or historic resources and invisible elements such as community values, traditions, and expectations.

CSS is both process and product, characterized by a number of attributes. It involves all stakeholders, including community members, elected officials, interest groups, and affected local, state, and federal agencies. It puts project needs and both agency and community values on a level playing field and considers all trade-offs in decision making. Through early, frequent, and meaningful communication with stakeholders, and a flexible and creative approach to design, the resulting projects should improve safety and mobility for the traveling public, while seeking to preserve and enhance the scenic, economic, historic, and natural qualities of the settings through which they pass.

CSS is guided by four core principles:

1. Strive towards a shared stakeholder vision to provide a basis for decisions.
2. Demonstrate a comprehensive understanding of contexts.
3. Foster continuing communication and collaboration to achieve consensus.

4. Exercise flexibility and creativity to shape effective transportation solutions, while preserving and enhancing community and natural environments.

Context sensitive designs incorporate a multidisciplinary design team. Residents, business owners, local institutions, city officials, and designers all have a part in the design and implementation of CSS. The conventional approach to design would be to approach the stakeholders at the tail end of the design phase in order to gain approval; involving these people at the beginning of the project ensures that the needs of all the stakeholders and the public are addressed from start to finish. Addressing these needs in the early stages can save valuable time and money in the development process.

Conventional designs place importance strictly on level of service and moving traffic. CSS balances safety, mobility, community, and environmental goals. The idea is to achieve a design that creates a unity for all of the users and for the area. CSS focuses not only on moving traffic, but also on pedestrians, bicycles, and aesthetic issues. Roads are built around the needs of pedestrians and bicyclists instead of just being built to handle the highest amount of traffic at the highest speeds possible. A properly constructed road will be safe for all users, regardless of their mode of travel. A CSS allows flexibility for its users when choosing their travel type.

CSS should encourage “smart growth” within the area. This refers to a type of city center growth that discourages urban sprawl by creating an area where pedestrians, bikes, transit, and vehicles can function in harmony within the network. Mixed-use development is also used in the area to allow for a variety of activities to take place. CSS creates a sense of community and unity to the area, while increasing safety levels and aesthetic value to the area.

Another purpose of CSS is to give users flexibility in the design process of transportation elements. All projects are different and should be treated as such. It is appropriate for some areas to incorporate 12-foot-wide travel lanes, for example, while others may benefit more from smaller 10-foot-wide lanes. The FHWA’s *Flexibility in Highway Design* is a guide written for highway engineers and project managers that describes the flexibility available when designing roads and illustrates successful approaches used in other highway projects.

The "Qualities that Characterize Excellence in Transportation Design", elaborated at the Thinking Beyond the Pavement in 1998, illustrate the desired end products of the CSS process:

- The project satisfies the purpose and needs as agreed to by a full range of stakeholders. This agreement is forged in the earliest phase of the project and amended as warranted as the project develops.
- The project is a safe facility for both the user and the community.
- The project is in harmony with the community, and it preserves environmental, scenic, aesthetic, historic, and natural resource values of the area, i.e., exhibits context sensitive design.
- The project exceeds the expectations of both designers and stakeholders and achieves a level of excellence in people's minds.
- The project involves efficient and effective use of the resources (time, budget, community) of all involved parties.
- The project is designed and built with minimal disruption to the community.
- The project is seen as having added lasting value to the community.

7.1. Benefits of CSS

As more organizations apply CSS principles, evidence continues to grow that measurable benefits result from this broadly informed and flexible approach to all phases of transportation decision making. Involving

stakeholders in decision making yields transportation solutions that balance environmental, engineering, community, mobility, funding, and safety needs with the minimum of delay and controversy. As an approach to transportation, CSS offers many important benefits[1]:

- CSS solves the right problem by broadening the definition of "the problem" that a project should solve, and by reaching consensus with all stakeholders before the design process begins.
- CSS conserves environmental and community resources. CSS facilitates and streamlines the process of NEPA compliance.
- CSS saves time. It shortens the project development process by gaining consensus early, and thereby minimizing litigation and redesign, and expediting permit approvals.
- CSS saves money. By shortening the project development process and eliminating obstacles, money as well as time is saved.
- CSS builds support from the public and from the regulators. By partnering and planning a project with the transportation agency, these parties bring full cooperation, and often additional resources as well.
- CSS helps prioritize and allocate scarce transportation funds in a cost-effective way, at a time when needs far exceed resources.
- Group decisions are generally better than individual decisions. Research supports the conclusion that decisions are more accepted and mutually satisfactory when made by all who must live with them.
- CSS is the right thing to do. It serves the public interest, helps build communities and leaves a better place behind.

7.2. Recommendation

It is recommended that language and themes supporting CSS be included in the LRTP. Also pertinent to the discussion would be the inherent limitations and competing factors that have to be balanced when considering CSS within the greater context of a community transportation system.

8.0 INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) technologies have been used widely used throughout the country to improve safety and efficiency for the transport of people and goods. ITS advances transportation safety and mobility and enhance productivity by integrating advanced communications technologies into transportation infrastructure and into vehicles.

ITS encompasses a broad range of wireless and traditional communications-based information and electronic technologies. Some of the most common ITS technologies deployed across the country include electronic toll collection, ramp meters, red light cameras, traffic signal coordination, transit signal priority, and traveler information systems. These applications are briefly described below:

- **Electronic Toll Collection** – Electronic toll collection systems support the collection of payment at toll plazas using automated systems that increase the operational efficiency and convenience of toll collection. Systems typically consist of vehicle-mounted transponders identified by electronic readers located in dedicated or mixed-use lanes at toll plazas.
- **Ramp Meters** - Traffic signals on freeway ramp meters alternate between red and green signals to control the flow of vehicles entering the freeway. Metering rates can be altered based on freeway traffic conditions.

[1] http://contextsensitivesolutions.org/

- **Red Light Cameras** – Red light cameras detect a motor vehicle that passes over sensors in the pavement after a traffic signal has turned red. The sensors connect to computers in high-speed cameras, which take two photographs of the violation. Typically, the first photo is taken of the front of the vehicle when it enters the intersection, and the second photo is taken of the rear of the vehicle when the vehicle is in the intersection. Law enforcement officials review the photograph, and a citation is mailed to the registered owner of the vehicle.
- **Traffic Signal Coordination** – This technology provides the ability to synchronize multiple intersections to enhance the operation of one or more directional movements in a system. Some examples include arterial streets, downtown networks, and closely spaced intersections such as diamond interchanges.
- **Transit Signal Priority** – These systems give special treatment to transit vehicles at signalized intersections. TSP systems use sensors to detect approaching transit vehicles and alter signal timings to improve transit performance. For example, some systems extend the duration of green signals for public transportation vehicles when necessary.
- **Traveler Information Systems** – Traveler information systems are multimodal and support many categories of drivers and travelers. Traveler information applications use a variety of technologies, including dynamic message signs, Internet websites, telephone hotlines, and television and radio, to allow users to make informed decisions regarding trip departures, routes, and mode of travel.

MDT has been proactive in the use of ITS to promote improve the flow and efficiency of the existing transportation network in the state, most notably through upgrades to traffic signal systems and implementing traveler information systems. The use of ITS technology on traffic signal systems can have multiple benefits, including reducing congestion, reducing vehicle emissions and fuel use, improving safety at intersections, and delaying or eliminating the need to construct additional road capacity.

MDT has developed a statewide traffic signal system plan, which includes recommendations for ITS improvements to be implemented in signal systems across the state over the next decade, with a focus on Montana's urban centers. Within the Great Falls urban area, projects to upgrade controllers and communications capabilities to enhance traffic signal operations at 18 intersections long 10th Avenue South and 6 intersections along the 3rd Street NW – NW Bypass have been completed.

MDT has implemented the 511 system, using a simple 3-digit telephone number, that provides current information to travelers about road conditions, allowing for better choices of travel time, transportation mode, and route. Dynamic message signs are also employed at key locations on the road network to advise motorists of changing travel conditions.

MDT routinely considers the applicability of incorporating ITS features as part of its project development activities for improvements to the state highway system. As improvements to the state-maintained highway system are proposed within the Great Falls urban area, opportunities to implement effective ITS technologies will be considered.

9.0 LIVABILITY

Livability is a national movement with local implications that are supported within the Great Falls community. Providing transportation options to improve access to housing, jobs, businesses, services and social activities are fundamental desires of most transportation system user groups. Active transportation results in a physically fit population, minimizes auto emissions, extends the life of transportation infrastructure, and delays the needs for infrastructure improvements.

Fostering livability in transportation projects and programs will result in improved quality of life; will create a more efficient and accessible transportation network; and will serve the mobility needs of communities, families, and businesses.

9.1. What is Livability?

The concept of livability, which has evolved over the years, is often used to describe a range of initiatives aimed at improving community quality of life while supporting broader sustainability goals. Livability encompasses multi-dimensional issues relative to community design, land use, environmental protection and enhancement, mobility and accessibility, public health, and economic well-being. Incorporating livability into transportation planning, programs, and projects is not a new concept. Communities, developers, advocacy groups, businesses, and neighborhood residents have been working for generations to make places more livable through transportation initiatives, with varying degrees of support from local, regional, State, and Federal agencies. These initiatives have used a range of terms to describe an overlapping set of objectives and strategies-livability, sustainability, community impact assessment, scenario planning, land use and transportation, smart growth, walkable communities, new urbanism, healthy neighborhoods, active living, transit-oriented development, complete streets, context-sensitive solutions, and many others. The key concept behind livability in transportation: transportation planning is a process that must consider broader community goals.

Livability in transportation is about integrating the quality, location, and type of transportation facilities and services available with other more comprehensive community plans and programs to help achieve broader community goals such as access to a variety of jobs, community services, affordable housing, quality schools, and safe streets. This includes:

- Addressing road safety and capacity issues through better planning, design, and construction.
- Integrating health and community design considerations into the transportation planning process to create more livable places where residents and workers have a full range of transportation choices.
- Using TDM approaches and system management and operation strategies to maximize the efficiency of transportation investments.
- Maximizing and expanding new technologies such as ITS, green infrastructure, and quiet pavements.
- Developing fast, frequent, dependable public transportation to foster economic development and accessibility to a wide range of housing choices.
- Strategically connecting the modal pieces-bikeways, pedestrian facilities, transit services, and roadways-into a truly intermodal, interconnected system.
- Enhancing the natural environment through improved storm water mitigation, enhanced air quality, and decreased greenhouse gases.

Livability provides economic benefits to communities, businesses, and consumers. In practice, livable transportation systems accommodate a range of modes (walking, bicycling, transit, and automobiles) by creating mobility choice within more balanced multimodal transportation networks. This in turn helps support more sustainable patterns of development, whether in an urban, suburban, or rural context. Livable transportation systems can provide better access to jobs, community services, affordable housing, and schools, while helping to create safe streets, reduce energy use and emissions, reduce impacts on and enhance the natural and built environment, and support more efficient land use patterns.

9.2. Livability Principles

In June 2009, U.S. Secretary of Transportation Ray LaHood, U.S. Secretary of Housing and Urban Development Shaun Donovan, and U.S. EPA Administrator Lisa P. Jackson announced the new Interagency Partnership for Sustainable Communities to improve access to affordable housing, provide more transportation options, and lower transportation costs while protecting the environment in communities nationwide. The Partnership for Sustainable Communities works to coordinate federal housing, transportation, water, and other infrastructure investments to make neighborhoods more prosperous, allow people to live closer to jobs, save households time and money, and reduce pollution.

Because the concept of livability is place-based and context sensitive, its definition can differ depending on region and whether the community is an urban, suburban, exurban, or rural setting. However, the overall understanding of livability can be conveyed by five of the six principles established by the Sustainable Communities Partnership listed below. A livable community:

1. **Provides more transportation choices that are safe, reliable, and economical.** Develop transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health. This can be as simple as increasing walkability, to enable citizens to park their car once in a downtown area, and access their daily needs by foot from that location. Providing transportation to critical social services for rural residents who can't drive is another valuable livability option.

2. **Promotes equitable, affordable housing options.** Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation. This refers to an availability of location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities – like neighborhoods with mixed-use, mixed-income housing where a retired couple can live in the same community as a recent college graduate.

3. **Enhances economic competitiveness.** Through reliable and timely access to employment centers, educational opportunities, services and other basic needs, livable communities are those which have higher economic resilience and more economic opportunities. They provide expanded business access to markets – largely through increased accessibility and mobility choices.

4. **Supports and targets funding toward existing communities.** Instead of developing on new land – which can be a waste of funding and resources – livable communities target development toward such strategies as transit oriented, mixed-use development and land recycling – to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.

5. **Values communities and neighborhoods.** The purpose of livability is to enhance the unique characteristics of all communities by investing in healthy, safe and walkable neighborhoods.

The Partnership's sixth principle addresses the alignment of federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.

9.3. Benefits of Livability

Incorporating livability approaches into transportation, land use, and housing policies can help improve public health and safety, lower infrastructure costs, reduce combined household transportation and housing costs, reduce vehicle miles traveled, and improve air and water quality, among many other benefits.

- **Transportation, Development, and Environment:** How we plan and develop communities and choose to travel affects environmental quality. Providing more travel options in compact, connected communities leads to fewer car trips, which improve air and water quality. Developing more compactly, and reusing existing properties, can preserve rural lands and protect natural resources. Coordinating land use and development decisions with transportation investments can produce clear results.

- **Transportation and Safety:** Over the past 50 years, most roadways have been designed primarily for safer automobile and truck travel, which can make them less safe for pedestrians, older adults, children, people with disabilities, or bicyclists. More than 4,600 pedestrians and bicyclists died on U.S. roads in 2009 and more than 108,000 were injured. People who do not drive or have access to private vehicles, such as children and older adults, are disproportionately represented. Making roads safer for all users can have the added benefits of improving access jobs and services, reducing congestion, and sparking business and neighborhood investment.

- **Transportation and Health:** Communities that make it safe and easy to get around by walking, bicycling, and taking transit can generate a number of health benefits, such as reduced obesity; reduced cases of asthma/heart disease/cancer; increased safety, and improved access to schools, parks, and recreation and community facilities.

- **Transportation and Land Use:** Communities benefit when decisions about transportation and land use are made at the same time. Deciding to build houses, schools, grocery stores, employment centers, and transit stations close to one another—while providing a well-connected street network and facilities for walking or biking—provides more transportation choices and convenient access to daily activities. It also ensures community resources and services are used efficiently.

- **Transportation and Housing Costs:** Transportation is the second largest expense for most households after housing. Households living in auto-dependent locations spend 25 percent of its income on transportation costs. Housing that is located closer to employment, shopping, restaurants and other amenities can reduce household transportation costs to 9 percent of household income.

- **Transportation Management and Operations:** Transportation system management and operations (M&O) coordinates systems to make them more efficient, more convenient, more reliable, safer, and easier to use. M&O strategies make systems work better, allowing us to do more with less - less congestion, less money, less fuel, and less frustration. They support livability by increasing travel choices and efficiency—including transit, bicycling, and walking—while reducing emissions and resource use.

- **Transportation and Economic Development:** Livability and economic development are intertwined: livability draws businesses and businesses contribute to community quality of life through investments in the built environment, culture, and philanthropy. Businesses are choosing to locate in more accessible locations that combine transportation and housing choices, good

schools, gathering places, and natural amenities. Targeted transportation investments can improve access to jobs, education, shopping, and goods movement, while providing construction and operations jobs.

- **Transportation and Rural Livability:** Livability in rural areas focuses on the towns, villages, working lands and natural resources that surround and connect them. Rural communities vary widely based on location, geography, economic and resource base, and other factors. "Rural" can describe farming, destination, gateway, resource-based, recreational, or other types of communities. Transportation investments that support rural livability also vary depending on location and context. For rural areas between towns or lands on the urban fringe, livability can mean safer highways and intersections, context-sensitive roadway design, multi-purpose trails, or rural on-demand transit and carpool information linked to smartphones. In small towns and villages, livability can mean a revitalized Main Street, sidewalks and improved crossings, a gateway entry, senior housing in walking distance to a redeveloped shopping district, or new neighborhoods built on the town's existing walkable street network.

- **Freight and Livability:** Getting goods to people and businesses is an essential part of building stronger regional economies, increasing community quality of life, and maintaining the nation's role in a global economy. While freight movement can impact livability and community quality of life, careful planning can help balance freight and livability needs. Communities can be aesthetically pleasing, safe, and walkable, while still providing efficient access for large trucks, rail lines, and other modes of transportation. The HUD-DOT-EPA livability principles call for enhancing economic competitiveness, through reliable and timely access to jobs and services, and expanded business access to markets, as well as for supporting existing communities and valuing communities and neighborhoods.

The FHWA has produced a series of fact sheets on each of the topics above which provide more detailed information and examples[2].

9.4. Livability and the LRTP

The LRTP should reflect the future transportation needs of the Great Falls area and include recommended actions, programs and projects to improve, enhance and better manage and operate the public transit and highway systems, promote alternative modes, accommodate bicyclists and pedestrians, consider other non-motorized modes of transportation, provide freight mobility and mitigate environmental impacts. In general, recommendations in the LRTP should also adhere to the livability principles established by the US DOT, HUD and EPA which are aimed at improving access to affordable housing, providing more transportation options, and lower transportation costs. By keeping these considerations in mind, transportation improvement programs and projects will not only accommodate existing travel, make the current transportation system more efficient, meet growing travel requirements and improve mobility, but also be a catalyst for enhancing the overall livability of the Great Falls community.

Livability is about linking the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets. This includes addressing safety and capacity issues on all roads through better planning and design, making judicious decisions about improvement projects, and expanding the use of new technologies.

The LRTP continues local efforts to make the transportation network operate as efficiently and effectively as possible and promote a balanced transportation system with alternatives to the private vehicle. The

[2] http://www.fhwa.dot.gov/livability/fact_sheets/

analyses conducted for the update of the LRTP show that some components of the system operate poorly and congestion occurs daily and reaches severe conditions at some locations. However, it is important to preserve and maintain essential infrastructure and services, while making the system operate as efficiently as possible. It is also equally critical to enhance the mobility of people and goods by increasing mode choice, access and convenience, and strategically expanding transportation capacity. Although the highway system dominates movement, non-highway components are equally important and provide alternatives for other system users.

The LRTP also attempts to reinforce future local land use development objectives and economic revitalization goals. Transportation and land use planning have a similar goal: efficient use of a limited resource (land) that allows for the efficient movement of people and goods. Together, transportation and land use planning will lead to the creation of strong communities and better define quality of life and livability in Great Falls.

The City's recent Growth Policy Update (*Imagine Great Falls 2025*) recommends a concept referred to as "Healthy by Design." This is a holistic concept that promotes health, safety and neighborhood oriented considerations in land use review. Many of the goals of Healthy by Design are occurring naturally in Great Falls. This includes an emphasis on trails, safe and comfortable sidewalks, community gardens and small scale commercial and mixed-use projects.

10.0 ENVIRONMENTAL MITIGATION

Moving Ahead for Progress in the 21st Century (MAP-21) was passed by Congress and signed into law by President Obama in July 2012. The bill replaces the extensions to the Safe, Accountable, Flexible, Efficient, Transportation Equity Act, a Legacy for Users (SAFETEA-LU) federal legislation that were in place during the previous LRTP update. Section 6001 of SAFETEA-LU (Environmental Considerations in Planning) required metropolitan LRTPs to discuss environmental mitigation opportunities and required certain elements and activities to be included in the development of long-range transportation plans, including:

- Consultations with resource agencies, such as those responsible for land-use management, natural resources, environmental protection, conservation and historic preservation.
- Consultations to compare transportation plans to conservation plans, maps, and inventories of natural or historic resources.
- A discussion of potential environmental mitigation activities.
- A participation plan that identifies a process for stakeholder involvement.

These provisions originated from a desire to realize benefits for overall transportation project development by considering environmental resources early on in the transportation planning process. The early consideration of environmental resources can assist in program predictability, project decision-making, project deliverability, and mitigation decisions while responding to the desire to improve both transportation infrastructure and the environment.

While MAP-21 streamlined the environmental review process for some transportation projects, the new legislation reiterates the need, as SAFETEA-LU did, for a discussion in the planning process that addresses:

> *"… potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental*

functions affected by the plan. This discussion shall be developed in consultation with federal, state, and Tribal wildlife, land management, and regulatory agencies."

In December 2012 letter to the Environmental Quality Council, Secretary of Transportation Ray LaHood elaborated several important principles the Department of Transportation intended to follow when implementing MAP-21. Three of the principles specifically address environmental considerations in the transportation planning process and during project development activities including:

- Implementing MAP-21 in a way that uses NEPA and other Federal environmental statutes to promote better environmental outcomes, improve transparency, and support informed decision-making.
- Promoting environmental stewardship, transparency, and early inter-agency consultation and collaboration as it carries out all of the new mandates of MAP-21.
- Encouraging early collaboration among agencies, project sponsors, affected stakeholders and the public to avoid adverse impacts to communities and the environment, minimize or mitigate impacts that may occur, and avoid project delay.

10.1. Environmental Mitigation Overview

Environmental mitigation is the process of addressing damage to the human and/or natural environment caused by transportation or other public works and infrastructure projects. The human and natural environment includes such resources as neighborhoods and communities; homes and businesses; cultural resources (archaeological or historical sites); parks and recreation areas; streams and wetlands; important farmlands; wildlife and their habitats; and air and water quality.

Environmental mitigation activities, in reference to transportation planning, refers to the strategies, policies, programs, actions, and activities that, over time, will serve to avoid, minimize, or compensate for the negative effects of a transportation project on the human and/or natural environment. Actions taken to avoid or minimize environmental damage are considered the most preferable method of mitigation. Potential environmental mitigation activities may include:

- Avoiding impacts altogether;
- Altering a proposed activity or project to minimize its potential effects on environmental resources;
- Repairing or restoring impacted resources;
- Implementing precautionary and/or abatement measures to reduce construction impacts;
- Employing special features or operational management measures to reduce impacts over time; and
- Compensating for environmental impacts by providing suitable, replacement or substitute environmental resources of equal or greater value, on or off-site.

This ordered approach to mitigation—known as "sequencing"—involves understanding the affected environment and assessing the effects of transportation projects as they are developed. Effective mitigation starts at the beginning of the NEPA process, not at the end. Mitigation must be an integral part of the alternatives development and analysis process.

Federal transportation planning regulations indicate the mitigation activities described in the LRTP are to be at the policy and/or strategic level and not project specific.

10.2. Consultation and Coordination

MAP-21 reiterates the need, as SAFETEA-LU did, for continued consultations with agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation in the development of LRTPs. Consistent with this requirement, Federal, State, and Tribal land management wildlife, and regulatory agencies were contacted in October 2013 for input regarding mitigation activities that may help alleviate the adverse effects of implementing transportation projects in the Great Falls area. Information about the Great Falls Area LRTP, a map of the LRTP study area, and an environmental mitigation matrix summarizing potential impacts and possible mitigating actions were provided to each agency. The matrix also identified readily-available maps and other information sources that can be used to help assess whether key environmental resources in the Great Falls area may be affected by transportation projects and listed agency contact information. Agencies were asked to review the matrix and provide comments about its content. The agencies contacted in October 2013 are listed below:

Federal Agencies

- Federal Highway Administration - Montana Division
  U.S. Army Corps of Engineers - Montana Regulatory Office
- Bureau of Land Management - Montana State Office
- U.S. U.S. Bureau of Land Management - Undaunted Stewardship Program
- Fish & Wildlife Service - Montana Field Office (Ecological Services)
- U.S. Environmental Protection Agency, Region 8 - Montana Office
- National Park Service - Intermountain Regional Director
- Malmstrom Air Force Base - 341st Missile Wing Public Affairs Office

State Agencies

- Montana Department of Transportation - Great Falls District Administrator
- Montana Department of Transportation - Rail, Transit, and Planning Division
- Montana Department of Transportation - Environmental Services Bureau
- Montana Department of Environmental Quality - Air Resources Protection Bureau
- Montana Department of Environmental Quality - Water Protection Bureau
- Montana Department of Environmental Quality - Wetlands Protection Program
- Montana Department of Environmental Quality - Waste and Underground Tank Management Bureau
- Montana Dept. of Natural Resources & Conservation - Trust Land Management Division
- Montana Dept. of Natural Resources & Conservation – Central Land Office
- Montana Dept. of Natural Resources & Conservation – Water Resources - Floodplain Management
- Montana Fish Wildlife & Parks - Region 4 Fisheries Manager
- Montana Fish Wildlife & Parks - Region 4 Parks Manager
- Montana Fish Wildlife & Parks - Region 4 Wildlife Manager
- Montana Historical Society - State Historic Preservation Office

Local Agencies

- Cascade County Conservation District
- Cascade County Planning Department
- Cascade County Floodplain Administrator
- Cascade County Road Department

- City of Great Falls - Public Works Department
- City of Great Falls - Park and Recreation Department
- City of Great Falls - Floodplain Administrator
- City of Great Falls - Great Falls Planning Department
- Great Falls/Cascade County Historic Preservation Office - Historic Preservation Officer
- West Great Falls Flood Control & Drainage District

NATIVE AMERICAN TRIBES

- Little Shell Tribe of Chippewa Indians of Montana
- Chippewa Cree Tribe
- Blackfeet Nation

10.3. IMPACTS OF TRANSPORTATION PROJECTS

The implementation of transportation projects may result in both positive and negative impacts on the human and natural environments and impacts may include direct, indirect, and cumulative effects. Direct effects are those impacts that are caused by the action and occur at the same time and place. Indirect impacts (also referred to as secondary impacts) are effects caused by the project, but occur at a different location or later time than the action that triggers the effect. Cumulative effects are the collective impacts on the environment that may occur when the project is considered along with other past, present, and reasonably foreseeable future actions.

Because this section of the LRTP discusses environmental mitigation, only potentially adverse or negative impacts are discussed. Environmental resources and areas within the community are generally affected by transportation projects as a result of land acquisition for new or expanded rights-of-way, construction, and the resulting effects of the project (such as increased traffic or traffic-generated noise, storm water runoff from paved surfaces, etc.). The following paragraphs discuss the types of environmental impacts that may result from the implementation of transportation projects in the Great Falls area. It should be noted that these environmental impact categories are not all inclusive and each transportation project must typically undergo Federal and State environmental compliance reviews to identify project-specific impacts, evaluate the need for mitigation activities, and determine permitting requirements.

AIR QUALITY

National ambient air quality standards (NAAQS) have been established for several major pollutants referred to as "criteria" pollutants. The six criteria pollutants are: Carbon monoxide (CO); Particulate Matter; Nitrogen dioxide (NO2); Sulfur dioxide (SO2); Ozone; and Lead (Pb). Transportation contributes to four of the six criteria pollutants: ozone, CO, particulate matter, and NO2.

Vehicle exhaust is a primary source of project-related air pollution. Increasing vehicle emissions is a potential outcome of projects that encourage additional miles of travel. Projects that are designed to reduce congestion and increase traffic flow can also encourage drivers to use such roadways more often and therefore increase CO emissions and other vehicle generated air pollutants. However, such projects often result in decreased travel times and idling times, which translates into reduced emissions. The net result is often an improvement in air quality.

The 10th Avenue South corridor was designated as a CO nonattainment area in 1980 but redesignated to an attainment area in 2002. DEQ utilizes an alternative CO monitoring method that includes an annual review of traffic volumes using data from MDT permanent automatic traffic counters (ATR) in Great Falls. Thresholds are defined based on the percent increase in consecutive, rolling 3-year ADT volumes and

correlated to presumed changes in ambient CO concentrations to demonstrate ongoing compliance with the CO NAAQS.

NOISE

Noise is most often defined as unwanted sound. Although sound can be easily measured, the perceptibility is subjective and the physical response to sound complicates the analysis of its impact on people. The environmental impact of noise is a function of the sensitivity of the land use where noise is heard. In general, land use sensitivity to noise is a function of human annoyance and community reaction rather than health and safety considerations. Noise can also interfere with nonresidential uses such as schools, libraries, churches, and hospitals.

The noise generated from new or expanded transportation facilities may have a negative impact on adjoining land uses. Traffic noise impacts must typically be investigated in areas adjacent to federally-aided highways for proposed construction of a highway on a new location or the reconstruction of an existing highway to either significantly change the horizontal or vertical alignment or increase the number of through-traffic lanes. If impacts are identified, then abatement measures must be considered and feasible and reasonable noise abatement must be incorporated into the project design.

HAZARDOUS MATERIALS

Transportation projects have the potential for encountering contaminated soils or groundwater, leaking underground storage tanks and piping, or other sources of hazardous materials in the planned work areas. These sites may occur throughout the community and sites are often found along major transportation corridors and established commercial/industrial areas.

In March 2011 EPA, with support from the MDEQ, added the Anaconda Copper Mining Co. (ACM) Smelter and Refinery site to the National Priorities List of Superfund sites. The site is a former metals refinery adjacent to the unincorporated community of Black Eagle in Cascade County.

The City of Great Falls and Cascade County also have numerous brownfields sites that could be encountered during the development of transportation projects. Brownfields are defined as real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

IMPORTANT FARMLANDS

Transportation projects have the potential to require new or expanded rights-of-way and it is possible that some projects outside the urban area may convert areas of important farmland to non-agricultural use. The Natural Resources Conservation Service (NRCS) has designated areas of important farmland (prime farmland, unique farmland, or farmland of statewide or local importance). The Farmland Protection Policy Act (FPPA) regulates federal actions with the potential to convert existing such farmlands to nonagricultural uses. Federally-funded transportation projects that would permanently convert designated farmland to a non-agricultural use are subject to FPPA coordination.

WILDLIFE AND HABITAT

The construction of new or improved transportation facilities could result in the disturbance, displacement, and/or minor loss of habitat for wildlife species. Transportation projects can also disrupt habitat connectivity and result in habitat fragmentation. Habitat fragmentation is mainly the result of different forms of land use change. The construction and use of transport infrastructure is one of the major agents causing this change as well as creating barriers between habitat fragments.

In accordance with the Endangered Species Act (ESA), the U.S. Fish & Wildlife Service (USFWS) maintains a listing of threatened, endangered, proposed and candidate species for Cascade County. The agency has also designated critical habitat for some species. Listed species designations may change over time.

Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS to ensure that actions they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

The construction of new or improved transportation facilities could result in the disturbance and/or minor loss of wildlife habitat. Species can also be displaced (through loss of habitat, increased noise, and increased human activity). Loss of habitat connectivity or habitat fragmentation can be indirect effects of transportation projects.

PARKS AND RECREATION LANDS

Transportation projects typically affect parks and recreation lands through the direct acquisition of land for new or expanded rights-of-way, temporary occupancy that adversely affects the property, or by indirect effects such as noise, vibration, diminished access, or visual intrusions.

Section 4(f) of the *Department of Transportation Act of 1966*, provides protection for public parks, recreation areas, wildlife and waterfowl refuges and historic sites of national, State, or local significance. Section 4(f) generally prohibits the use of such lands unless there are no feasible and prudent alternatives and requires projects to include all possible planning to minimize harm.

Parks and recreation lands are often acquired or developed with federal funding assistance from the Land and Water Conservation Fund Act (LWCFA). This funding restricts the future use of parklands or open spaces that have been improved with funds received through the LWCFA. The conversion of lands or facilities acquired with LWCFA funds must be coordinated with the Department of Interior and replacement in kind is typically required.

CULTURAL RESOURCES

Cultural resources are any prehistoric or historic remains of past human activities including artifacts, sites, structures, landscapes or districts, and objects of importance to a culture or community for scientific, traditional, religious, or other reasons. Like parks and recreation lands, transportation projects have the potential to adversely affect cultural resource sites directly through the acquisition of land for new or expanded rights-of-way or indirectly by changing the site's surroundings or diminishing the qualities of the resource itself.

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into consideration the effects of their projects on cultural resources that are on or eligible for listing in the National Register of Historic Places (NRHP).

Section 4(f) of the *Department of Transportation Act of 1966*, also provides protection for historic sites of national, State, or local significance.

ENVIRONMENTAL JUSTICE

Title VI of the US Civil Rights Act of 1964, as amended, EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* and Order DOT 5610.2, Environmental Justice require that no minority, or, by extension, low-income person shall be disproportionately adversely impacted by any project receiving federal funds.

For transportation projects, this means that no particular minority or low-income person may be disproportionately isolated, displaced, or otherwise subjected to adverse effects. Potential impacts are assessed in terms of property acquisitions or relocations, changes in access to employment areas, and other changes in low-income and minority communities/neighborhoods.

COMMUNITY IMPACTS

Transportation projects have the potential to result in effects on a community and its quality of life. Topics that fall under the Community Impact heading include: access, mobility, social isolation/splitting of neighborhoods, history of the community, new development impacts, changes in the quality of life, changes in neighborhood identification, changes in property values, separation of the neighborhood from community facilities, displacements, impacts on community centers of activity whether formal or informal, noise, urban renewal, removal of urban blight, joint land use, and disruption of the natural and human environment.

To establish potential impacts, it is necessary to determine the characteristics of the affected area, such as neighborhood boundaries, locations of residences and businesses, demographic information, economic data, the social history of communities, and identify what community based land use plans say about the area. Impacts are best analyzed in conjunction with public involvement activities for the affected neighborhood or community.

FLOODPLAINS

Transportation projects occasionally require crossing or working within delineated floodplains. Floodplain involvement (encroachment) typically requires measures to: 1) Avoid significant floodplain encroachment where practicable; 2) Minimize the impact of highway actions that adversely affect the base floodplain; or 3) be compatible with the National Flood Insurance Program of the Federal Emergency Management Agency (FEMA).

Protection of floodplains and floodways is required by Executive Order 11988, "Floodplain Management" and USDOT Order 5650.2, "Floodplain Management and Protection." The intent of these regulations is to avoid or minimize highway encroachments within the 100-year (base) floodplains, where practicable, and to avoid supporting land use development which is incompatible with floodplain values. Where encroachment is unavoidable, the regulations require appropriate measures to minimize impacts.

STREAMS, WETLANDS, AND AQUATIC RESOURCES

Transportation projects occasionally require crossing or working within perennial or intermittent streams, wetlands, and other aquatic resources. Unavoidable impacts to streams or wetlands may require a variety of permits or authorizations including:

- Nationwide or Individual Section 404 Permit from the Corps of Engineers;
- Section 10 Permit (Navigable Waters) from the Corps of Engineers;
- Stream Protection Act 124 Permit from Montana Fish Wildlife & Parks;
- Short-term Water Quality Standard for Turbidity (318 Authorization); and
- 310 Permits from the Cascade Conservation District (for actions undertaken by non-governmental agencies).

Transportation projects involving construction activities that will disturb one or more total acres including clearing, grading, and excavating also require Montana Pollutant Discharge Elimination System (MPDES) "General Permit" from the Montana Department of Environmental Quality.

10.4. Environmental Mitigation Measures

Table 4 lists possible mitigating measures to help avoid, minimize, or compensate for negative project-related impacts. The mitigation activities identified in the table are not project-specific; however, they are representative of the types of actions commonly implemented with transportation projects. Future transportation projects will be developed within the context of all applicable state and federal rules and regulations and will be subject to relevant environmental compliance and permitting requirements.

Current contact information for federal, state, and local agencies that may need to be consulted during the assessment of project-related impacts and the development of environmental mitigation measures is also provided in **Table 4**.

When developing environmental impacts and appropriate mitigation measures, it is important to be aware of the following considerations:

- Mitigation measures should be considered within the context of the proposed improvement and generally reflect the magnitude and extent of potential impacts.
- Mitigation measures are usually most effective when they occur in close proximity to the area of impact. The appropriate location for many mitigation measures is often within the existing (or expanded) right-of-way and within the limits of the proposed transportation project.
- Environmental impacts and associated mitigation measures should be holistically considered. For example, erecting a noise wall to help alleviate negative transportation noise impacts could result in negative visual impacts to adjoining properties or impede crossings of the transportation facility.
- The appropriate mitigation may include a combination of different actions or measures.
- Environmental approvals and permit authorizations may establish specific actions to mitigate the negative effects of individual projects.
- Mitigation measures must be developed in cooperation with appropriate regulatory agencies and an adequate level of public participation.
- Provisions for long-term maintenance of mitigation measures may be necessary and should be developed in cooperation with the appropriate regulatory agencies, impacted landowners, and/or the public.

Table 4: Possible Environmental Mitigation Measures and Sources

	Possible Mitigation Measures or Actions	Potential Information Sources	Agencies to Consult
Air Quality	• Implement Transportation Demand Management (TDM) measures like telecommuting, carpooling, or flexible work hours to promote off-peak commuting. • Promote alternate modes of transportation such as transit, bicycling and walking. • Expand non-motorized facilities within the community.	Nonattainment Area Maps: http://deq.mt.gov/AirQuality/Planning/AirNonattainment.mcpx	**Montana Dept. of Environmental Quality** Air Resources Protection Bureau 1520 E 6th Ave PO Box 200901 Helena, MT 59620-0901 406-444-2544 **Montana Department of Transportation** Environmental Services Bureau PO Box 200507 Helena, MT 59620-0507 406-444-7659
Noise	• Sound-dampening walls, earthen berms, and/or buffering landscaping. • Soundproofing structures at impacted noise-sensitive uses. • Low-noise pavements. • Relocation of impacted uses. • Innovative design features (depressed roadways) to reduce impacts. • Implement local land use planning measures to help avoid development of new noise sensitive uses in proximity to transportation corridors.	Federal Highway Administration – Noise Guidance: http://www.fhwa.dot.gov/environment/noise/ Montana Department of Transportation – Traffic Noise Analysis and Abatement Policy: http://www.mdt.mt.gov/business/contracting/docs/npolicy-2011.pdf	**Montana Department of Transportation** Environmental Services Bureau PO Box 200507 Helena, MT 59620-0507 406-444-7659
Hazardous Materials	A comprehensive survey within the LRTP study area was not conducted to identify existing hazardous materials or possible sources of contamination. Hazardous materials encountered during a project should be removed, treated, or otherwise addressed after consultation with appropriate regulatory agencies. Remediation measures will vary depending on type, extent, location and characteristics of the material, and proximity to adjacent land uses or underground water sources.	Natural Resource Information System (NRIS) Interactive mapping - Federal Superfund Sites, Solid Waste Facilities, Crude Oil Pipelines, EPA Toxic Release Inventory, Abandoned/Active Mines: http://maps2.nris.mt.gov/mapper/ CECRA (State Superfund Sites): http://deq.mt.gov/StateSuperfund/Cecra.mcpx MDEQ Interactive Mapping - Petroleum Tank Release Compensation Sites Remediation Response Sites, Leaking Underground Storage Tanks, Hazardous Waste Handlers: http://svc.mt.gov/deq/wmadst/ Brownfields Sites in Montana and Hazardous Substance Brownfields Registry: http://www.deq.mt.gov/Brownfields/BrownfieldsSites.mcpx	**U.S. Environmental Protection** Agency Region 8 Montana Office Federal Building 10 W. 15th Street, Suite 3200 Helena, MT 59626 406-457-5038 **Montana Dept. of Environmental Quality** 1100 North Last Chance Gulch PO Box 200901 Helena, MT 59620-0901 Remediation Division 406-841-5000 Permitting and Compliance Division Hazardous Waste Section 406-444-2876 Waste and Underground Tank Management Bureau 406-444-5300
Farmland Impacts	• Avoidance of important farmlands where practicable. • Consider alternate sites that reduce impacts on important farmlands.	Natural Resource Conservation Service – Soil maps and Farmland Classifications: http://websoilsurvey.nrcs.usda.gov/app/	**Natural Resource Conservation Service** Great Falls Field Office (serves Cascade County Conservation District) 12 3rd Street NW Great Falls, MT 59404-1991 406-727-7580

	Possible Mitigation Measures or Actions	Potential Information Sources	Agencies to Consult
Threatened and Endangered Species	Assess potential occurrences of listed species or critical habitat within the project areas and make an appropriate determination of effect (i.e. "no effect"/"may affect" and "may affect, not likely to adversely affect"/"may affect, likely to adversely affect" on listed and proposed species or "is not likely to jeopardize the continued existence of a federal proposed or candidate species") based on proposed project activities. If adverse impacts to listed species or critical habitat are unavoidable, then appropriate conservation measures would be determined through consultation procedures with the USFWS under Section 7 of the ESA.	Listed Species in Cascade County: http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/countylist.pdf Montana Natural Heritage Program – Species searches for project areas: http://mtnhp.org/ Montana Fish Wildlife & Parks – Species information: http://fwp.mt.gov/fishAndWildlife/species/	**U.S. Fish & Wildlife Service** Ecological Services Montana Field Office 585 Shepard Way, Suite 1 Helena, MT 59601 406-449-5225 **Montana Fish Wildlife & Parks** FWP Region 4 Headquarters Regional Wildlife and Fisheries Managers 4600 Giant Springs Road Great Falls, MT 59405 406-454-5840
Wildlife, Fisheries and Habitat	• Wildlife crossing provisions on transportation corridors including overpass or underpasses and culverts that accommodate wildlife passage. • Create new or enhanced habitat in key areas. • Seeding disturbed areas with natural grasses or vegetation to re-establish habitat. • Restore streambanks to pre-existing or better conditions. • Fencing to direct wildlife away from roadway. • Maintain or provide fish passage with drainage facilities.	Montana Fish Wildlife & Parks – Crucial Areas Assessment mapping: http://fwp.mt.gov/fishAndWildlife/conservationInAction/crucialAreas.html Montana Fish Wildlife & Parks – GIS data and mapping: http://fwp.mt.gov/doingBusiness/reference/gisData/dataDownload.html Montana Fish Wildlife & Parks – Montana Fisheries Information System (MFISH): http://fwp.mt.gov/fishing/mFish/ Montana Natural Heritage Program – Species Searches/Species of Concern Reports: http://mtnhp.org/	**Montana Fish Wildlife & Parks** FWP Region 4 Headquarters Regional Wildlife and Fisheries Managers 4600 Giant Springs Road Great Falls, MT 59405 406-454-5840
Park and Recreation Lands	• Avoid impacts to park and recreation lands when possible. • If impacts cannot be avoided, identify and coordinate appropriate mitigation measures with officials with jurisdiction over the affected resources. • Provide improved recreational functions or values at affected lands. • Provide replacement park or recreational land of equal value, usefulness and proximity.	City of Great Falls Park and Recreation Department: http://www.greatfallsmt.net/recreation City of Great Falls Planning and Community Development: http://www.greatfallsmt.net/planning/comprehensive-planning Cascade County Planning Department: http://departments.cascadecountymt.gov/planning Montana Fish Wildlife & Parks Public Lands Searches: http://fwp.mt.gov/recreation/visitFwpSite.html LWCF Grants awarded within Cascade County: http://waso-lwcf.ncrc.nps.gov/public/index.cfm	**City of Great Falls** Park and Recreation Department P.O. Box 5021 Great Falls, MT 59403 406-771-1265 **Cascade County** Planning Department 121 4th Street North #2H-2I Great Falls, MT 59401 406-454-6905 **Montana Fish Wildlife & Parks** FWP Region 4 Headquarters Regional Parks Manager 4600 Giant Springs Road Great Falls, MT 59405 406-454-5840 **National Park Service** Intermountain Region 12795 Alameda Parkway Denver, CO 80225 303-969-2500

	Possible Mitigation Measures or Actions	Potential Information Sources	Agencies to Consult
Cultural Resources	Identify "Area of Potential Effects" (APE) which is usually limited to the footprint of the project including all existing and required rights-of-way and easements. Complete research and/or conduct a survey for historic (50 years of age or older) resources within the APE to identify all individual properties, districts, and multiple property areas that are on, in, or eligible for listing in the NRHP. This is also applicable to former lands formerly occupied by Native American Tribes and Traditional Cultural Properties. Mitigate adverse impacts by: • Design modifications to avoid or complement the property. • Preservation in place for archaeological resources. • Landscaping to reduce visual impacts. • Photo documentation. • Historic archival recording and documentation to preserve historic resource information for the public. • Develop educational materials about affected resource. • Adoption/reuse of historic bridges. • Relocation of a historic structure to avoid the loss of a resource.	Montana State Historic Preservation Office – Project area file searches: http://mhs.mt.gov/shpo/CulturalRecords.asp Montana State Historic Preservation Office – National Register sites for Cascade County: http://mhs.mt.gov/shpo/register/NRmap/NRmap.asp Montana Department of Transportation Environmental Services Bureau (Helena) Archaeologist and Historian	**Montana Historical Society** State Historic Preservation Office 1410 Eighth Avenue Helena, MT 59620 406-444-7715 **Great Falls/Cascade County** Historic Preservation Office Planning & Community Development Office PO Box 5021 Great Falls, MT 59403 406-455-8435
Environmental Justice	• Identify if Environmental Justice or disadvantaged populations exist in project area. • Engage Environmental Justice or disadvantaged populations during project development activities. • Land acquisition and residential or commercial relocations necessary for any federally-assisted transportation projects would be accomplished in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act).	U.S. Census Bureau, American Community Survey – Social, Demographic, Economic, and Housing for 1, 3, 5 year periods (Cascade County and City of Great Falls: http://ceic.mt.gov/ACS.aspx Montana Census and Economic Information Center – Demographic/economic information: http://ceic.mt.gov/	**City of Great Falls** Great Falls Planning Department Civic Center, Room 112 Great Falls, MT 59403 406-454-0495 **Cascade County** Planning Department 121 4th Street North #2H-2I Great Falls, MT 59401 406-454-6905
Community Impacts	• Community visioning. • Community impact planning studies. • Incorporate context sensitive design elements. • Streetscape enhancements (decorative lighting and pavements, pedestrian amenities, wayfinding signs, etc.). • Low impact lighting for more appropriate integration into neighborhoods. • Median landscaping. • New or improved non-motorized facilities to enhance linkages within and out of the neighborhood. • Traffic calming measures.	U.S. Census Bureau, American Community Survey – Social, Demographic, Economic, and Housing for 1, 3, 5 year periods: http://ceic.mt.gov/ACS.aspx Montana Census and Economic Information Center – Demographic/economic information: http://ceic.mt.gov/ City of Great Falls – Planning and Community Development – Growth Policy: http://www.greatfallsmt.net/planning/comprehensive-planning Cascade County Planning Department – Growth Policy: http://departments.cascadecountymt.gov/planning	**City of Great Falls** Great Falls Planning Department Civic Center, Room 112 Great Falls, MT 59403 406-454-0495 **Cascade County** Planning Department 121 4th Street North #2H-2I Great Falls, MT 59401 406-454-6905

	Possible Mitigation Measures or Actions	Potential Information Sources	Agencies to Consult
Floodplains	• Conduct location hydrology studies to establish existing hydraulic conditions and extent of encroachment, quantify potential impacts, and identify appropriate mitigating measures. • Consider alternatives which reduce impacts to the floodplain. • Design and construct transportation facilities in a cost-effective manner such that their components are excluded from the floodway.	FEMA Map Service Center- Currently Issued Flood Maps for Cascade County/City of Great Falls: https://msc.fema.gov/webapp/wcs/stores/servlet/StoreCatalogDisplay?storeId=10001&catalogId=10001&langId=-1&userType=G DNRC Water Resources – Floodplain Management: http://dnrc.mt.gov/wrd/water_op/floodplain/ City of Great Falls Growth Policy Update – Community Floodplain Graphic: http://www.greatfallsmt.net/sites/default/files/fileattachments/growth_policy_update_-_august_6_2013.pdf US Army Corps of Engineers – National Levee Database: http://nld.usace.army.mil/egis/f?p=471:1	**City of Great Falls** Floodplain Administrator Planning & Community Development Civic Center, P.O. Box 5021 Great Falls, MT 59403 406-455-8431 **Cascade County** Floodplain Administrator Cascade County Planning Office 121 4th Street North #2H-2I Great Falls, MT 59401 406- 454-6905 **US Army Corps of Engineers** Omaha District 1616 Capitol Avenue Omaha, NE 68102-4901
Wetlands and Streams	Compensatory mitigation involves actions taken to offset unavoidable adverse impacts to wetlands, stream and other aquatic resources authorized by CWA Section 404 and other COE permits. Compensatory mitigation can be achieved through four methods: restoration of a previously-existing wetland/aquatic site; enhancement of an existing aquatic site's functions; creation of a new aquatic site; or preservation of an existing aquatic site. Appropriate mitigating measures will depend on the characteristics of the affected area and may be determine in cooperation with the agencies responsible for issuing permits. Permit conditions may include: • Developing alternatives to avoidance impacts. • Incorporating design features to avoid or minimize impacts (such as bridges, fish passage provisions, and placing natural streambed materials in the bottom of culverts). Mitigation for impacts to streams must be consistent with the 2013 Montana Stream Mitigation Procedure (MTSMP) developed by the Corps of Engineers. The MTSMP describes the method for quantifying the adverse impacts (debits) and the acceptable compensatory mitigation (credits) for projects that would result in more than a minimal adverse impact to a stream. The MTSMP also discusses mitigation procedures and appropriate types of mitigation activities for stream impacts. Mitigating wetland and stream impacts through approved mitigation banks or the Montana Statewide In-Lieu Fee (ILF) Mitigation Program are other options. The ILF Mitigation Program was created through an agreement between the EPA, USFWS, MDEQ, MFWP, COE, and the not-for-profit corporation, Montana Aquatic Resources Services, Inc.	Interactive National Wetlands Inventory Maps (Riparian and Wetland Areas): http://www.fws.gov/wetlands/Data/Mapper.html U.S. Environmental Protection Agency – Wetlands Information: http://water.epa.gov/type/wetlands/ Montana Stream Permitting Guide: http://dnrc.mt.gov/Permits/StreamPermitting/Guide.asp Corps of Engineers – Jurisdictional Information: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/juris_info.aspx Corps of Engineers – Montana Stream Mitigation Procedure: http://www.nwo.usace.army.mil/Portals/23/docs/regulatory/MT/Mitigation/MTSMP-Revised-February%202013.pdf RIBITS (Regulatory In lieu fee and Bank Information Tracking System): http://geo.usace.army.mil/ribits/index.html Montana Aquatic Resources Statewide In-Lieu Fee Program: http://montanaaquaticresources.org/programs	**U.S. Army Corps of Engineers** Montana Regulatory Office 10 West 15th Street, Suite 2200 Helena, MT 59626 406-441-1375 **Montana Fish Wildlife & Parks** FWP Region 4 Headquarters Regional Fisheries Manager 4600 Giant Springs Road Great Falls, MT 59405 406-454-5840 **Montana Department of Environmental Quality** 1520 E 6th Ave PO Box 200901 Helena, MT 59620-0901 Water Protection Bureau 406-444-3080 Wetlands Protection Program 406-444-6652

	Possible Mitigation Measures or Actions	Potential Information Sources	Agencies to Consult
Storm Sewer Discharge	The Montana Department of Environmental Quality (DEQ) Small Municipal Separate Storm Sewer System (MS4) permit is required for urban areas within the state of Montana that have storm sewer systems that serve a population of at least 10,000 people. Areas included in the permit are Billings, Missoula, Great Falls, Butte, Helena, Kalispell, and Bozeman. Cities, counties, universities, military bases, and the Montana Department of Transportation (MDT) are some of the entities required to obtain the permit for these areas. Under the permit, they are required to develop, implement, and enforce a Storm Water Management Program (SWMP) designed to reduce the discharge of pollutants from the Small MS4, to protect water quality, and to satisfy the appropriate water quality requirements of the Montana Water Quality Act. This SWMP must include the development and implementation of Best Management Practices (BMPs) and measurable goals for the following six "minimum control measures": 1. Public education and outreach on stormwater impacts; 2. Public involvement/participation; 3. Illicit discharge detection and elimination; 4. Construction site stormwater runoff control; 5. Post-construction stormwater management in new development and redevelopment; and, 6. Pollution prevention and good housekeeping for municipal operations. In some of the designated Small MS4 areas, the co-permittee (e.g. the city government) has agreed to be the lead agency with MDT providing technical or financial support, and implementing limited BMPs or portions of the shared SWMP. Generally, MDT is responsible for implementing and maintaining elements of the shared SWMPs in their own jurisdictional areas unless otherwise stipulated in the agreements between the co-permittee agencies.	U.S. Environmental Protection Agency – NPDES (MS4s) http://cfpub.epa.gov/npdes/stormwater/munic.cfm Montana Department of Environmental Quality – MPDES General Permit (MS4s): http://www.deq.mt.gov/wqinfo/MPDES/StormWater/ms4.mcpx Montana Department of Transportation – Stormwater Information (MS4 Permits): http://www.mdt.mt.gov/pubinvolve/stormwater/permits.shtml	**Department of Environmental Quality** 1520 E 6th Ave PO Box 200901 Helena, MT 59620-0901 Water Protection Bureau 406-444-3080 **Montana Department of Transportation** PO Box 201001 Helena MT 59620-1001 Statewide MS4 Program 406-444-0825

10.5. Areas to Consider for Mitigation Activities

The list of potential negative impacts discussed earlier can usually be mitigated effectively. Areas where mitigation efforts can be focused in the Great Falls area are discussed below.

Mitigation Areas for Impacts to Streams, Wetlands and Aquatic Habitat

Transportation projects along or across the Missouri and Sun Rivers could potentially affect water quality, riparian areas, fish and wildlife habitat, wetlands, and other environmentally sensitive areas. Additionally, such projects may affect public or neighborhood access to river front areas. Consequently, lands adjoining these river corridors are ideal locations for mitigating such impacts. These lands offer opportunities to: create or enhance wetlands and riparian areas; improve water quality by filtering runoff; reduce erosion of stream banks; protect development from potential flooding; and improve access to and the quality of riverfront lands. Some of the same opportunities exist in the Sand Coulee Creek, Watson Coulee, and Gibson Flats areas.

For unavoidable adverse impacts to wetlands and aquatic resources that cannot be mitigated on-site, it may be necessary to secure mitigation through the use of established mitigation banks or and in-lieu fee mitigation. The City of Great Falls and Cascade County areas within the LRTP study area lie within

Watershed #7-Missouri-Sun-Smith River Basin. Several mitigation banking opportunities exist within this watershed. MDT acquired approximately 64 acres of wetland credit from Ducks Unlimited at Little Muddy Creek Wetland Mitigation Site to mitigate for wetland impacts associated with transportation projects in the watershed. Efforts are currently underway to develop the privately-held Missouri-Sun-Smith Mitigation Bank (MSSMB) within this watershed. Once established, wetland and stream mitigation credits will be available for purchase and the credits can be used as acceptable mitigation under Section 404.

Mitigating wetland and stream impacts through the Montana Statewide In-Lieu Fee (ILF) Mitigation Program is also a possibility. The ILF Mitigation Program was created through an agreement between the EPA, USFWS, MDEQ, MFWP, COE, and the not-for-profit corporation, Montana Aquatic Resources Services, Inc. The objective of the ILF program is to mitigate for impacts to wetlands and streams by developing compensatory mitigation projects with each of the sixteen major watersheds in Montana.

Mitigation for Impacts to Archaeological and Historical Resources

Compliance with the *Historic Preservation Act* and coordination with the Montana State Historic Preservation Office will typically establish appropriate mitigation measures for impacts to cultural resources.

Area museums such as the History Center, the Lewis & Clark National Historic Trail Interpretive Center, the Charles M. Russell Museum, or the First Peoples Buffalo Jump Interpretive Center are all potential repositories for excavated artifacts or historical items.

Relocation of historic structures are most appropriate if they occur near their original locations. MDT's Adopt-A-Bridge Program provides a mechanism for the preservation and reuse of historic bridges in other locations in the community. Several historic bridges in the Great Falls area have been adopted and used in furthering the development of non-motorized transportation corridors.

Mitigation for Impacts to Parklands

If new lands are purchased, they should be in proximity to the impacted parklands and/or serve a similar function as provided by the impacted parkland. Other mitigation measures should be implemented in the immediate vicinity of the affected parkland and transportation project.

Mitigation for Neighborhood Impacts

Transportation improvement projects, especially capacity expansion projects, can separate neighborhoods, inhibit pedestrian and bicycle travel, and have negative physical impacts on adjoining properties or land uses. Considerations for pedestrian and bicyclist safety at intersections and effective arterial crossings at other key locations can help reduce adverse effects to non-motorized facility users. Incorporating landscaping, streetscape amenities and traffic calming measures into transportation projects may also help alleviate negative impacts on neighborhoods.

11.0 TRANSPORTATION INFRASTRUCTURE RESILIENCE AND RELIABILTY

Transportation infrastructure is confronted with notable vulnerabilities: an aging transportation system; increasing interdependencies between physical and electronic systems controlling the infrastructure; incidents related to the nearby production or transport of potentially hazardous materials; and flooding or wildfire threats caused by extreme weather events. Considered together, these vulnerabilities pose significant challenges for critical transportation infrastructure at the local, statewide, and national levels.

For these reasons, transportation systems must be developed with the concept of resiliency in mind. The concept of "resiliency" as it relates to transportation systems means providing a system that can better withstand and recover rapidly from disruptions like natural disasters, structural failures, or human-caused incidents. A resilient transportation system possesses three main attributes—a design capable of withstanding severe disruptions, adaptiveness so that adequate responses can be made to threats or disruptions, and appropriate response and recovery operations to mitigate the consequences of the disruptions. Resiliency helps ensure transportation infrastructure is reliable, adaptable, and survivable during and after disruptions.

The Great Falls area is not immune from the potential for significant disruptions to its transportation systems. The LRTP should include recommended actions, programs and projects that reflect the concept of resiliency by:

- Strengthening existing transportation facilities by identifying existing vulnerable transportation facilities and systems;
- Prioritizing future investment in critical facilities, corridors, systems, or routes that must remain functional during a crisis or be most rapidly restored;
- Considering infrastructure designs that are sustainable and capable of being operated within changing environmental and operational conditions;
- Strategically expanding the transportation system to create redundancies and make the system more flexible and adaptive;
- Using effective stormwater management systems and techniques to help alleviate vulnerabilities to transportation infrastructure; and
- Merging transportation and land use planning to better plan for development in vulnerable areas of the community.

With these considerations in mind, transportation improvement programs and projects will not only accommodate existing and projected travel within the community, but ensure the transportation system is adaptable enough to function reliably during disruptions due to natural disasters, structural failures, or human-caused incidents.

12.0 TRAVEL AND TOURISM

Travel and tourism, which includes travel for both business purposes and for leisure, represents a significant share of Montana's economy. The interdependence of transportation and tourism and travel is apparent since those visiting and recreating in Montana arrive via various forms of transportation and rely primarily on the road system to travel to and from cultural, historical, and recreational sites within the state. This interdependence has become more critical with the expansive growth of tourism/recreation across Montana and its associated increasing economic impact in many communities, including Great Falls.

The LRTP recognizes the benefits to the Great Falls area generated through the travel and tourism industry and supports efforts to provide an integrated transportation system. The LRTP supports actions, programs and projects that:

- Contribute to economic development in the community;
- Improve the condition, safety, and efficiency of the transportation system;
- Enhance mobility within the community and intermodal connections;
- Increase wayfinding and traveler information services for area visitors; and
- Facilitate and support the interstate and interregional transportation of passengers for tourism, commercial, and recreational activities.

These measures will help create and sustain an integrated transportation network and contribute to the overall economic vitality of Great Falls.

APPENDIX H:
Transportation Funding



TRANSPORTATION FUNDING

April 12, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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TRANSPORTATION FUNDING

1.0 BACKGROUND

Transportation improvements can be implemented using Federal, State, local and private funding sources. Historically, Federal and State funding programs have been used almost exclusively to construct and upgrade the major roads in the Great Falls area. Considering the current funding limits of these traditional programs, and the extensive list of recommended road projects, it is apparent that more funding will be required from local and private sources if all of the transportation network needs are to be met.

This memorandum discusses the financial plan for the 2018 LRTP, projected out to the year 2038. Federal legislation requires that the LRTP be "fiscally constrained"; in other words, the cost of implementing and maintaining transportation improvements should be within a funding amount that can reasonably be expected to be available during the life of the plan.

Federal regulations establish the requirements for the financial plan in Title 23, Section 450.322(f)(10), of the Code of Federal Regulations. To summarize, the regulations (effective December 2007) state that the financial plan should include the following:

- Estimates of costs and revenue sources needed to operate and maintain federal-aid highways and public transportation
- Estimates of funds that will be available to support the LRTP implementation and that are agreed upon by the MPO, public transportation operator(s), and the state
- Recommendations on any additional financing strategies to fund projects and programs included in the LRTP
- Revenue and cost estimates that use an inflation rate to reflect "year of expenditure dollars" and that have been developed cooperatively by the MPO, state, and public transportation operator

Funding to implement the LRTP recommendations comes from federal, state, and local sources. This financial element of the LRTP includes estimates of costs that would be required to implement the LRTP as well as estimates of existing and contemplated sources of funds available to pay for these improvements.

Much of the following information concerning the Federal and State funding programs was assembled with the assistance of the Statewide and Urban Planning Section of the Montana Department of Transportation (MDT). The intent was to identify traditional Federal, State and local sources of funds for transportation related projects and programs in the Great Falls area. A narrative description of each potential funding source is provided, including: the source of revenue; required match; purpose for which funds are intended; means by which the funds are distributed; and the agency or jurisdiction responsible for establishing priorities for use of the funds.

2.0 OVERVIEW OF TRADITIONAL FUNDING SOURCES

MDT administers several programs that are funded from state and federal sources. Each year, in accordance with 60-2-127, Montana Code Annotated (MCA), the Montana Transportation Commission allocates a portion of available federal-aid highway funds for construction purposes and for projects located on the various systems in the state as described throughout this memorandum.

The following list includes Federal and State funding sources developed for the distribution of Federal and State transportation funding. This includes Federal funds the State receives under the Fixing America's Surface Transportation Act (FAST Act) which was signed into law on December 4, 2015. The FAST Act authorizes federal transportation funding for federal fiscal years 2016 through 2020. The list also includes local funding sources available through the city and county, as well as private sources. It should be understood that other funding sources are possible, but those listed below reflect the most probable sources at this time. A narrative description of each source is provided in the following sections of this memorandum.

3.0 FEDERAL FUNDING SOURCES

The following summary of major Federal transportation funding categories received by the State through Titles 23-49 U.S.C., including state developed implementation/sub-programs that may be potential sources for projects. In order to receive project funding under these programs, projects must be included in the State Transportation Improvement Program (STIP) and the MPO TIP, where relevant.

3.1. National Highway Performance Program (NHPP)

The National Highway Performance Program (NHPP) provides funding for the National Highway System (NHS), including the Interstate System and NHS roads and bridges. The purpose of the NHS is to provide an interconnected system of principal arterial routes which will serve major population centers, international border crossings, intermodal transportation facilities, and other major travel destinations; meet national defense requirements; and serve interstate and interregional travel. The NHS includes all Interstate routes, a large percentage of urban and rural principal arterials, the defense strategic highway network, and strategic highway connectors.

Allocations and Matching Requirements

NHPP funds are Federally-apportioned to Montana and allocated to Districts by the Montana Transportation Commission. Based on system performance, the funds are allocated to three programs; Interstate Maintenance, National Highway, and NHPP Bridge. The Montana Transportation Commission establishes priorities for the use of NHPP funds, and projects are let through a competitive bidding process.

Eligibility and Planning Considerations

Activities eligible for the National Highway System funding include construction, reconstruction, resurfacing, restoration, and rehabilitation of segments of the NHS roadway; construction, replacement, rehabilitation, preservation and protection of bridges on the National Highway System; projects or part of a program supporting national goals for improving infrastructure condition, safety, mobility, or freight movements on the National Highway System; and reconstruction, resurfacing, restoration, rehabilitation, or preservation of a bridge on a non-NHS Federal-aid highway so long as bridge condition provision requirements are satisfied. Operational improvements, projects to reduce risk of failure of critical infrastructure, as well as highway safety improvements are also eligible. Other miscellaneous activities that may qualify for NHS funding include bikeways and pedestrian walkways, environmental mitigation,

restoration and pollution control, infrastructure based intelligent transportation systems, traffic and traveler monitoring and control, and construction of intra or inter-city bus terminals serving the National Highway System.

The MDT Great Falls District is anticipated to receive an average annual NH apportionment of approximately $20 million during the next five years. Current Great Falls District priorities already under development total an estimated construction cost of $128 million. Eligible NH funding is currently committed through federal fiscal year (FFY) 2022 as documented in the 2018-2022 STIP. Unfunded Great Falls District projects total approximately $28 million.

3.1.1. Interstate Maintenance

Interstate Maintenance funds are Federally-apportioned to Montana and allocated based on system performance by the Montana Transportation Commission. The Commission approves and awards projects for improvements on the Interstate Highway System which are let through a competitive bidding process. MDT districts are allocated IM funds by Montana's Transportation Commission based on system performance. The federal share for this program is 91.24% and the State is responsible for the remaining 8.76%. The State share is funded through the Highway State Special Revenue Account (HSSRA).

3.1.2. National Highway

The Federal share for non-Interstate NHS projects is 86.58% and the State is responsible for the remaining 13.42%. The State share is funded through the Highway State Special Revenue Account.

3.1.3. NHPP Bridge

Federal and state funds under this program are used to finance bridge inspection, improvement, and replacement projects on Interstate and non-Interstate National Highway System routes. NHPB program funding is established at the discretion of the state. However, Title 23 U.S.C. establishes minimum standards for NHS bridge conditions. If more than 10% of the total deck area of NHS bridges in a state is on structurally deficient bridges for three consecutive years, the state must direct NHPB funds equal to 50% of the state's FY 2009 Highway Bridge Program to improve bridges each year until the state's NHS bridge condition meets the minimum standard.

3.2. Surface Transportation Program (STP)

Surface Transportation Block Grant Program (STBG) funds are federally apportioned to Montana and allocated by the Montana Transportation Commission to various programs including the Surface Transportation Program Primary Highways (STPP), Surface Transportation Program Secondary Highways (STPS), the Surface Transportation Program Urban Highways (STPU), and the Surface Transportation Program – Bridge Program (STPB), as well as set-asides for programs including Transportation Alternatives (TA) and Recreational Trails. The Federal share for these projects is 86.58% with the non-Federal share typically funded through HSSRA. The Montana Transportation Commission establishes priorities for the use of STBG funds and projects are let through a competitive bidding process.

3.2.1. Secondary Highway System (STPS)

The Federal and State funds available under this program are used to finance transportation projects on the state-designated Secondary Highway System. The Secondary Highway System includes any highway that is not classified as a local route or rural minor collector and that has been selected by the Montana Transportation Commission to be placed on the Secondary Highway System. Funding is distributed by

formula and is utilized to resurface, rehabilitate and reconstruct roadways and bridges on the Secondary System.

Allocations and Matching Requirements

Secondary funds are distributed statewide (MCA 60-3-206) to each of five financial districts, based on a formula, which takes into account the land area, population, road mileage and bridge square footage. Federal funds for secondary highways must be matched by non-Federal funds. Of the total received 86.58% is Federal and 13.42 % is non-Federal match. Normally, the match on these funds is from the Highway State Special Revenue Account.

Eligibility and Planning Considerations

Eligible activities for the use of Secondary funds fall under three major types of improvements: Reconstruction, Rehabilitation, and Pavement Preservation. Vehicle-to-infrastructure communication equipment is also eligible for funding. The Reconstruction and Rehabilitation categories are allocated a minimum of 65% of the program funds with the remaining 35% dedicated to Pavement Preservation. Priorities are identified in consultation with the appropriate local government authorizes and approved by the Montana Transportation Commission.

3.2.2. Urban Highway System (STPU)

The Federal and State funds available under this program are used to finance transportation projects on Montana's Urban Highways System, as per MCA 60-3-211. STPU allocations are based on a per capita distribution and are recalculated each decade following the US Census.

Allocations and Matching Requirements:

State law guides the allocation of urban funds to projects on the Urban Highway System in Montana's urban areas (population of 5,000 or greater) through a statutory formula based on each area's population compared to the total population in all urban areas. The federal share for this program is 86.58% and the State is responsible for the remaining 13.42%. The State share is funded through the HSSRA.

Montana's urban areas are as follows:

Anaconda	Columbia Falls	Helena	Miles City
Belgrade	Kalispell	Glendive	Missoula
Billings	Great Falls	Laurel	Sidney
Bozeman	Hamilton	Lewistown	Whitefish
Butte	Havre	Livingston	

Eligibility and Planning Considerations:

Urban funds are eligible for rehabilitation, resurfacing, new construction, reconstruction of existing facilities, operational improvements, vehicle-to-infrastructure communication equipment, bicycle facilities, pedestrian walkways, carpool projects and traffic operation projects on the 430 miles of the State-designated Urban Highway System. Priorities for the use of urban funds are established at the local level through local planning processes with final approval by the Transportation Commission.

3.2.3. Bridge Program (STP)

The Federal and state funds available under this program are used to finance bridge projects for on-system and off-system routes in Montana. Title 23 U.S.C. requires that a minimum amount (equal to 15 percent of Montana's 2009 Federal Bridge Program apportionment) be set aside for off-system bridge projects. The remainder of the Bridge Program funding is established at the discretion of the state. Bridge Program funds are primarily used for bridge rehabilitation or reconstruction activities on Primary,

Secondary, Urban or off-system routes. Projects are identified based on bridge condition and performance metrics.

3.2.4. Urban Pavement Preservation Program (UPP)

The Urban Pavement Preservation Program is a sub-allocation of the larger Surface Transportation Program that provides funding to urban areas with qualifying Pavement Management Systems (as determined jointly by MDT and FHWA). This sub-allocation is approved annually by the Transportation Commission and provides opportunities for pavement preservation work on urban routes (based on system needs identified by the local Pavement Management Systems).

3.2.5. Set-aside Program

The Set-aside Program, previously Transportation Alternatives (TA) Programs under MAP-21, requires MDT to obligate 50% of the funds within the state based on population, using a competitive process, while the other 50% may be obligated in any area of the state. The federal share for this program is 86.58% and the State is responsible for the remaining 13.42%. The State share is funded through the HSSRA if the project is on-system, the sponsor provides the match if the project is off-system.

Funds may be obligated for projects submitted by:

- Local governments,
- Transit agencies,
- Natural resource or public land agencies,
- School districts, schools, or local education authorities,
- Tribal governments, and
- Other local government entities with responsibility for recreational trails for eligible use of these funds.

Eligible categories include:

- On-road and off-road trail facilities for pedestrians and bicyclists, including ADA improvements;
- Historic preservation and rehabilitation of transportation facilities;
- Archeological activities relating to impact for a transportation project;
- Any environmental mitigation activity, including prevention and abatement to address highway related storm water runoff and to reduce vehicle/animal collisions including habitat connectivity;
- Turnouts, overlooks, and viewing areas;
- Conversion/use of abandoned railroad corridors for trails for non-motorized users;
- Inventory, control, and removal of outdoor advertising;
- Vegetation management in transportation right-of-way for safety, erosion control, and controlling invasive species;
- Construction, maintenance, and restoration of trail and development and rehabilitation of trailside and trailhead facilities;
- Development and dissemination of publications and operations of trail safety and trail environmental protection programs;
- Education funds for publications, monitoring, and patrol programs and for trail-related training;
- Planning, design, and construction of projects that will substantially improve the ability of students to walk and bicycle to school; and
- Non-infrastructure-related activities to encourage walking and bicycling to school, including public awareness campaigns, outreach to press and community leaders, traffic education and enforcement school vicinities, student sessions on bicycle and pedestrian safety, health, and environment, and funding for training.

The state is required to allocate TA funds through a competitive process which allows eligible applicants an opportunity to submit projects for funding. MDT's process emphasized safety, ADA, relationships to state and community planning efforts, existing community facilities, and project readiness.

3.3. National Highway Freight Program (NHFP)

The National Highway Freight Program was created by the FAST Act to invest in freight projects on the National Highway Freight Network. This program provides funding for construction, operational improvements, freight planning, and performance measures. This program is apportioned to States by formula. States must have a freight plan in place beginning FY 2018 in order to receive formula funding. Up to 10% of the apportioned funds may be used for intermodal projects. Generally, the Federal share for this program is 91.24% and the State is responsible for the remaining 8.76%. The State share is typically funded through the HSSRA for projects on state highways and local governments are responsible for providing the match for local projects.

3.4. Highway Safety Improvement Program (HSIP)

HSIP funds are apportioned to Montana for allocation to safety improvement projects approved by the Commission and are consistent with the strategic highway safety improvement plan. Projects described in the State strategic highway safety plan must correct or improve a hazardous road location or feature, or address a highway safety problem. The Commission approves and awards the projects which are let through a competitive bidding process. Generally, the Federal share for the HSIP projects is 90% with the non-Federal share typically funded through the HSSR account.

3.5. Congestion Mitigation and Air Quality Improvement Program (CMAQ)

Federal funds available under this program are used to finance transportation projects and programs to help improve air quality and meet the requirements of the Clean Air Act. Montana's air pollution problems are attributed to carbon monoxide (CO) and particulate matter (PM10).

Allocations and Matching Requirements

CMAQ funds are Federally-apportioned to Montana and allocated to various eligible programs by formula and by the Commission. As a minimum apportionment state, a Federally-required distribution of CMAQ funds goes to projects in Missoula since it was Montana's only designated and classified air quality non-attainment area. The remaining, non-formula funds, referred to as "flexible CMAQ" is primarily directed to areas of the state with emerging air quality issues through various state programs. The Transportation Commission approves and awards both formula and non-formula projects on MDT right-of-way. Infrastructure and capital equipment projects are let through a competitive bidding process. Of the total funding received, 86.58% is Federal and 13.42% is provided by the state for projects on state highways and by local governments for local projects. The State share is funded through the HSSRA.

Eligibility and Planning Considerations

In general, eligible activities include transit improvements, ADA upgrades, traffic signal synchronization, bicycle/pedestrian projects, intersection improvements, travel demand management strategies, traffic flow improvements, air quality equipment purchases, vehicle-to-infrastructure communication equipment, and public fleet conversions to cleaner fuels. At the project level, the use of CMAQ funds is not constrained to a particular system (i.e. Primary, Urban, and NHS). A requirement for the use of these funds is the estimation of the reduction in pollutants resulting from implementing the program/project. These estimates are reported yearly to FHWA.

3.5.1. CMAQ (formula)

Mandatory CMAQ funds that come to Montana based on a Federal formula and are directed to Missoula, Montana's only classified, moderate CO non-attainment area. Projects are prioritized through the Missoula Metropolitan planning process.

3.5.2. Montana Air & Congestion Initiative (MACI)–Guaranteed Program (flexible)

This is state program funded with flexible CMAQ funds that the Commission allocates annually to Billings and Great Falls to address carbon monoxide issues in these designated, but "not classified", CO non-attainment areas. The air quality in these cities is roughly equivalent to Missoula, however, since these cities are "not classified" they do not get direct funding through the Federal formula. Projects are prioritized through the respective Billings and Great Falls Metropolitan planning processes.

3.5.3. Montana Air & Congestion Initiative (MACI)–Discretionary Program (flexible)

The MACI – Discretionary Program provides funding for projects in areas designated non-attainment or recognized as being "high-risk" for becoming non-attainment. Since 1998, MDT has used MACI-Discretionary funds to get ahead of the curve for CO and PM10 problems in non-attainment and high-risk communities across Montana. District Administrators and local governments nominate projects cooperatively. Projects are prioritized and selected based on air quality benefits and other factors. The most beneficial projects to address these pollutants have been sweepers and flushers, intersection improvements, and signal synchronization projects.

3.6. Federal Lands Access Program (FLAP)

The Federal Lands Access Program was created by MAP-21 to improve access to Federal lands and is continued in the FAST Act. FHWA's Western Federal Lands Division administers the program and MDT is an eligible applicant for the funds.

The program is directed towards Public Highways, Roads, Bridges, Trails, and Transit systems that are under State, county, town, township, tribal, municipal, or local government jurisdiction or maintenance and provide access to Federal lands. The Federal Lands Access Program funds improvements to transportation facilities that provide access to, are adjacent to, or are located within Federal lands. The program supplements State and local resources for public roads, transit systems, and other transportation facilities, with an emphasis on high-use recreation sites and economic generators. Program funds are subject to the overall Federal-aid obligation limitation. Funds are allocated among the states using a statutory formula based on road mileage, number of bridges, land area, and visitation.

Allocation and Matching Requirements

The federal share for this program is 86.58% and the State provides match for projects on state highways that address MDT identified infrastructure condition deficiencies. Local governments provide the match for off-system projects. The State share is funded through the HSSRA. Funding is authorized and allocated for each state under U.S.C. Title 23, Chapter 2, MAP-21, Division A, Title I, Subtitle A, Section 1119 distribution formula.

Eligibility and Planning Considerations

The following activities are eligible for consideration on Federal Lands Access Transportation Facilities:

- Preventive maintenance, rehabilitation, restoration, construction and reconstruction.
- Adjacent vehicular parking areas.

- Acquisition of necessary scenic easements and scenic or historic sites.
- Provisions for pedestrian and bicycles.
- Environmental mitigation in or adjacent to Federal land to improve public safety and reduce vehicle-wildlife mortality while maintaining habitat connectivity.
- Construction and reconstruction of roadside rest areas, including sanitary and water facilities.
- Operation and maintenance of transit facilities.

Proposed projects must be located on a public highway, road, bridge, trail or transit system that is located on, is adjacent to, or provides access to Federal lands for which title or maintenance responsibility is vested in a State, county, town, township, tribal, municipal, or local government.

3.7. Congressionally Directed Funds

Congressionally directed funds may be received through either highway program authorization or annual appropriations processes. These funds are generally described as “demonstration” or “earmark” funds. Discretionary funds are typically awarded through a federal application process or Congressional direction. If a local sponsored project receives these types of funds, MDT will administer the funds in accordance with the Montana Transportation Commission Policy #5 – *“Policy Resolution Regarding Congressionally Directed Funding: Including Demonstration Projects, High Priority Projects, and Project Earmarks.”*

3.7.1. Nationally Significant Freight and Highway Projects

This program was also established by the FAST Act to create competitive grants or Tax Increment Financing Authority loans for projects >$100 million. This is a discretionary freight-focused grant program that allows States, MPOs, local governments, tribal governments, special purpose districts and public authorities (including port authorities), and other parties to apply for funding to complete projects that improve safety and hold the greatest promise to eliminate freight bottlenecks and improve critical freight movements. Generally, the Federal share for this program is 91.24% and the State is responsible for the remaining 8.76%. The State provides match for projects on state highways that address MDT identified infrastructure condition deficiencies; local governments provide the match for off-system projects. The State share is typically funded through the HSSRA.

Activities eligible for funding include:

- Highway freight projects on the National Highway Freight Network,
- NHS highway/bridge projects,
- Projects in National Scenic Areas,
- Freight rail/intermodal/port projects, and
- Rail-highway grade crossings or grade separation projects.

3.8. Transit Capital and Operating Assistance Funding

The MDT Transit Section provides federal and state funding to eligible recipients through Federal and state programs. Federal funding is provided through the Section 5310 and Section 5311 transit programs and state funding is provided through the TransADE program. MAP-21 incorporated the Job Access and Reverse Commute and New Freedoms Programs into the Section 5311 and 5310 programs, respectively. It also created a new bus and bus facilities discretionary formula program (Section 5339) for fixed route bus operators.

All funded projects must be derived from a locally developed, coordinated public transit-human services transportation plan (a “coordinated plan”). The coordinated plan must be developed through a process that includes representatives of public, private, and nonprofit transportation and human service providers and participation from the public.

3.8.1. Bus and Bus Facilities (Section 5339)

This program provides capital funding to replace, rehabilitate and purchase buses and related equipment and to construct bus-related facilities. Federal funds pay 80% of capital costs. The remaining 20% must come from the local recipient. Funds are also eligible to be transferred by the state to supplement urban and rural formula grant programs (5307 and 5311, respectively).

3.8.2. Enhanced Mobility of Seniors and Individuals with Disabilities (Section 5310)

Section 5310 authorizes capital grants to eligible organizations to assist in providing transportation for the elderly and/or persons with disabilities. The Federal Transit Administration (FTA) funds 80% of all costs for equipment, with a 20% match provided by the local recipient. Eligible recipients for this program are private, nonprofit organizations; public bodies approved by the State to coordinate services for elderly persons and persons with disabilities; or public bodies which certify to the Governor that no nonprofit organization is readily available in a service area to provide this transportation service. Ten percent of the state's Section 5310 apportionment can be used to administer the program, to plan, and to provide technical assistance.

3.8.3. Urbanized Area Formula Grants (Section 5307)

This program enhances the access of people in urbanized areas by providing public transportation. Federal funds pay 80% of capital costs and 50% of deficit operating costs. The remaining 20% and 50%, respectively, must come from the local recipient. The designated recipient of Section 5307 funds is the Governor who in turn can designate the funds to a public body. In Montana, the Governor has designated Missoula, Great Falls, and Billings as the recipients of the Section 5307 funds.

4.0 STATE FUNDING SOURCES

The following is a summary of Montana's State funding sources which can be allocated to local governments and counties. State funds are dispersed automatically and on a needs basis.

4.1. Rail/Loan Funds

The Montana Rail Freight Loan Program (MRFL) is a revolving loan fund administered by the Montana Department of Transportation to encourage projects for construction, reconstruction, or rehabilitation of railroads and related facilities in the State and implements MCA 60-11-113 to MCA 60-11-115. Loans are targeted to rehabilitation and improvement of railroads and their attendant facilities, including sidings, yards, buildings, and intermodal facilities. Rehabilitation and improvement assistance projects require a 30% loan-to value match. Facility construction assistance projects require a 50% match.

Eligible applicants for loans under the program include railroads, cities, counties, companies, and regional rail authorities. Port authorities may also qualify, provided they have been included in the state transportation planning process. Projects must be integrally related to the railroad transportation system in the State and demonstrate that they will preserve and enhance cost-effective rail service to Montana communities and businesses.

4.2. TransADE

The TransADE grant program offers operating assistance to eligible organizations providing transportation to the elderly and persons with disabilities.

Allocation and Matching Requirements

This is a state funding program within Montana statute. State funds pay 54.11% of deficit operating costs, 80% of administrative costs, and 80% of maintenance costs. The remaining 45.89%, 20%, and 20%, respectively, must come from the local recipient. Applicants are also eligible to use this funding as match for the Federal transit grant programs.

Eligibility and Planning Considerations

Eligible recipients of this funding are counties, incorporated cities and towns, transportation districts, or non-profit organizations. Applications are due to the MDT Transit Section by the first working day of March each year. To receive this funding the applicant is required by state law (MCA 7-14-112) to develop a strong, coordinated system in their community and/or service area.

4.3. State Funds for Transit Subsidies

The 46th Montana Legislature amended Section 7-14-102 MCA providing funds to offset up to 50 percent of the expenditures of a municipality or urban transportation district for public transportation. The allocation to operators of transit systems is based on the ratio of its local support for public transportation to the total financial support for all general-purpose transportation systems in the State. Local support is defined as:

$$Local\ Support = \frac{Expenditure\ for\ public\ transportation\ operations}{Mill\ value\ of\ City\ or\ urban\ transportation\ district}$$

4.4. State Fuel Tax

The State of Montana assesses a tax on each gallon of gasoline and clear diesel fuel sold in the state and used for transportation purposes. According to State law, each incorporated city and town within the State receives an allocation of the total tax funds based upon:

1) the ratio of the population within each city and town to the total population in all cities and towns in the State, and
2) the ratio of the street mileage within each city and town to the total street mileage in all incorporated cities and towns in the State. (The street mileage is exclusive of the Federal-Aid Interstate and Primary Systems.)

State law also establishes that each county be allocated a percentage of the total tax funds based upon:

1) the ratio of the rural population of each county to the total rural population in the state, excluding the population of all incorporated cities or towns within the county and State;
2) the ratio of the rural road mileage in each county to the total rural road mileage in the State, less the certified mileage of all cities or towns within the county and State; and
3) the ratio of the land area in each county to the total land area of the State.

Effective July 1, 2017, HB473, the Bridge and Road Safety and Accountability Act (BaRSAA) incrementally increases Montana's fuel tax rate for gasoline and for special fuel. House Bill 473 directs the fuel tax rate increase each biennium, until 2023, at the following increments in **Table 1**:

Table 1: Montana Fuel Tax Rate

Date	State Gas Rate	State Diesel Rate
July 1, 2017	0.315	0.2925
July 1, 2019	0.32	0.2945
July 1, 2021	0.325	0.2955
July 1, 2023	0.33	0.2975

A portion of the revenue generated by the increase will be allocated to local governments in addition to the existing fuel tax distributions provided for in MCA 15-70-101 and 7-14-102(2). BaRSAA funds are allocated in the same proportion and using the same ratios provided for in MCA 15-70-101(2)(b), (2)(c), and (3). Allocations are calculated based upon the statutory formula.

Local governments can use BaRSAA funds for the construction, reconstruction, maintenance, and repair of rural roads or city streets and alleys. The local government is responsible for maintenance. The purchase of capital equipment is not eligible for funding through this source. Funds may also be used to match federal funds used for the construction of roads and streets that are part of the National, Primary, Secondary or Urban Highway Systems; or road and streets which a local government is responsible to maintain.

Beginning March 1, 2018, local governments may request distribution of their allocation from MDT. Local governments must match each $20 requested for distribution with at least $1 of local government budgeted matching funds. Local governments can request distributions of allocated funds between March 1st and November 1st of the calendar year in which the funds were allocated. Reservation requests can be made between September 1st and November 1st.

For State Fiscal Year 2018, the City of Great Falls will receive $968,587.88, and Cascade County will receive $195,527.67 from MCA 15-70-101 and $2,325.50 from MCA 7-14-102(2) for a total of $197,853.17 in State fuel tax funds. The amount varies annually. For calendar year 2018, the City of Great Falls will be allocated $360,411.42, and Cascade County will be allocated $72,755.82, in BaRSAA. Priorities for the use of these funds are established by each jurisdiction.

5.0 LOCAL FUNDING SOURCES

Local governments generate revenue through a variety of funding mechanisms. Typically, several local programs related to transportation exist for budgeting purposes and to disperse revenues. These programs are tailored to fulfill specific transportation functions or provide particular services. The following text summarizes programs that are or could be used to finance transportation improvements by the city and county.

5.1. City of Great Falls

5.1.1. Special Revenue Funds

These funds are used to budget and distribute revenues that are legally restricted for a specific purpose. Several such funds that benefit the transportation system are discussed briefly in the following paragraphs.

5.1.2. SID Revolving Fund

This fund provides financing to satisfy bond payments for special improvement districts in need of additional funds. The city can establish street SID's with bond repayment to be made by the adjoining landowners receiving the benefit of the improvement. The city has provided labor and equipment for past projects through the General Fund, with an SID paying for materials.

5.1.3. Gas Tax Apportionment

Revenues are generated through State gasoline taxes apportioned from the State of Montana. The City's FY 2018 state gas tax apportionment will be approximately $968,587. Transfers are made from this fund to the General Fund to reimburse expenditures for construction, reconstruction, repair and maintenance of streets.

5.1.4. Street Maintenance Assessment

Every parcel within the city limits is assessed for street maintenance, with a square footage cap based on the type of property (residential versus commercial). Revenues generated from the assessment fund maintenance activities on public roadways. Street maintenance includes, but is not limited to, the following: sprinkling; graveling; oiling; chip sealing; seal coating; overlaying; treating; general cleaning; sweeping; flushing; snow and ice removal; and leaf and debris removal.

5.1.5. Great Falls Parking Commission

Monthly lease rental payments and meter collections fund this program. Revenues are used to fund parking improvements in the downtown area.

5.1.6. Tax Increment Financing (TIF)

Great Falls currently has five (5) active Tax Increment Financing (TIF) districts: 10 Central Montana Agricultural and Technology Park District; 2) West Bank Urban Renewal District; 3) Great Falls International Airport District; 4) East Industrial Park District, and; 5) Great Falls Downtown Urban Renewal District. The funds generated from the TIF could be used to finance projects including street and parking improvements; tree planting; installation of new bike racks; trash containers and benches; and other streetscape beautification projects. TIF funds were used to construct Innovation Street in 2015, and could possibly be used in other districts in the future.

5.1.7. Community Development Block Grant Program (CDBG)

Authorized in 1974, the CDBG program replaced a number of individual or categorical Federal assistance programs to cities, the Model Cities Program and Urban Renewal among the major ones. The funds are provided to metropolitan areas and urban counties with populations of 50,000 and above on an entitlement basis, with individual allocations determined by a formula of poverty, population, overcrowded housing, growth lag, and age of housing stock factors.

In Great Falls and Cascade County, the city is a direct recipient of the funds from the U.S. Department of Housing and Urban Development, whereas the County receives funds through the Montana Department of Commerce on a competitive basis. The State administers the block grant program and allocates funds to projects in small urban areas and counties based on a state adopted selection and priority program.

In planning for and using CDBG funds, recipients must ensure that no less than 51 percent of the funds must be used for activities that benefit low- and moderate-income persons, over a period specified by the grantee, but not to exceed three years.

There are numerous eligible activities for use of the funds, including construction of public facilities, which would include transportation improvements. Great Falls has used CDBG funds for many years to finance sidewalk repairs and handicap ramp installations. In some years, these funds have also been used for street paving and other street improvements.

5.2. Cascade County

Road Fund

The County Road Fund provides for the construction, maintenance, and repair of all county roads outside the corporate limits of cities and towns in Cascade County. Revenue for this fund comes from intergovernmental transfers (i.e., State gas tax apportionment and motor vehicle taxes), and a mill levy assessed against county residents living outside cities and towns. The county mill levy has a ceiling limit of 15 mills. Cascade County's FY 2018 state gas tax apportionment added approximately $197,853 to the Road Fund.

County Road Fund monies are primarily used for maintenance with little allocated for new road construction. It should be noted that only a small percentage of the total miles on the county road system are located in the study area. Projects eligible for financing through this fund will be competing for available revenues on a county-wide basis.

Bridge Fund

The Bridge Fund provides financing for engineering services, capital outlays, and necessary maintenance for bridges on all off system and Secondary routes within the county. These monies are generated through intergovernmental fund transfers (i.e., vehicle licenses and fees), and a county wide mill levy. There is a taxable limit of four mills for this fund.

Motor Vehicle License Fee

The fees collected by counties from the licensing of motor vehicles are available for construction, maintenance, and repair of highways and streets within the transportation study area. The revenue collected is distributed among the jurisdictional areas of the county based on vehicle registration. In 1987, the State of Montana changes its method of licensing motor vehicles of ¾ ton or less. The flat fee tax on light vehicles was replaced by a 2 percent tax on the assessed value of the vehicle, using average trade-in or wholesale value. An ad valerom tax is still issued for all vehicles in excess of ¾ ton. A use tax of 1.5% is imposed on the list price of all newly licensed vehicles. The proceeds of this tax are credited to the State highway account of the State Special Revenue Fund. The funds from the 2 percent tax are distributed in the relative proportions required by the levies for State, County, School District and municipal purposes in the same manner personal property taxes are distributed. Additionally, counties have the option of imposing a 0.5 percent local vehicle tax that is distributed, with some restrictions, in the same manner as the base vehicle tax.

Urban Transportation Districts

Urban Transportation Districts are another method of providing local funds for transportation improvements. The creation of an urban transportation district is initiated by a petition of at least 20 percent of the registered voters within the proposed district. A formal public hearing must be held after which the creation of the district is put to a vote. The county commissioners determine whether a special election is necessary, or if a vote can take place at the next general election. Urban Transportation Districts are governed by an elected board, which is responsible for all operations of the district. The Great Falls Transit District was created under and operates under the guidelines for Urban Transportation Districts.

County Elderly Activities Tax

Counties are allowed to levy up to one mill to promote, establish, and maintain recreational, educational, and other activities of the elderly. Funds from this source could be used to match the FTA Section 5310 funds for providing transportation services to the elderly and disabled.

Special Revenue Funds

Special revenue funds may be used by the county to budget and distribute revenues legally restricted to a specific purpose. Several such funds that benefit the transportation system are discussed briefly in the following paragraphs.

Capital Improvements Fund

This fund is used to finance major capital improvements to county infrastructure. Revenues are generated by loans from other county funds, and must be repaid within ten years. Major road construction projects are eligible for this type of financing.

Rural Special Improvement District (RSID) Revolving Fund

This fund is used to administer and distribute monies for specified RSID projects. Revenue for this fund is generated primarily through a mill levy and through motor vehicle taxes and fees. A mill levy is assessed only when delinquent bond payments dictate such an action.

Special Bond Funds

A fund of this type may be established by the county on an as-needed basis for a particularly expensive project. The voters must approve authorization for a special bond fund. The county is not currently using this mechanism.

Specialized Transportation Fund

This type of fund may be established to supplement the cost of transit service to disabled or low-income county residents. The county is not currently using this mechanism.

5.3. Private Funding Sources

Private financing of roadway improvements, in the form of right of way donations and cash contributions, has been successful for many years. In recent years, the private sector has recognized that better access and improved facilities can be profitable due to increases in land values and commercial development possibilities. Several forms of private financing for transportation improvements used in other parts of the United States are described in this section.

Cost Sharing

The private sector pays some of the operating and capital costs for constructing transportation facilities required by development actions.

Transportation Corporations

These private entities are non-profit, tax exempt organizations under the control of state or local government. They are created to stimulate private financing of highway improvements.

Road Districts

These are areas created by a petition of affected landowners, which allow for the issuance of bonds for financing local transportation projects.

Private Donations

The private donation of money, property, or services to mitigate identified development impacts is the most common type of private transportation funding. Private donations are very effective in areas where financial conditions do not permit a local government to implement a transportation improvement itself.

Private Ownership

This method of financing is an arrangement where a private enterprise constructs and maintains a transportation facility, and the government agrees to pay for public use of the facility. Payment for public use of the facility is often accomplished through leasing agreements (wherein the facility is rented from the owner), or through access fees whereby the owner is paid a specified sum depending upon the level of public use.

Privatization

Privatization is either the temporary or long term transfer of a public property or publicly owned rights belonging to a transportation agency to a private business. This transfer is made in return for a payment that can be applied toward construction or maintenance of transportation facilities.

General Obligation (G.O.) Bonds

The sale of general obligation bonds could be used to finance a specific set of major highway improvements. A G.O. bond sale, subject to voter approval, would provide the financing initially required for major improvements to the transportation system. The advantage of this funding method is that when the bond is retired, the obligation of the taxpaying public is also retired. State statutes limiting the level of bonded indebtedness for cities and counties restrict the use of G.O. bonds. The present property tax situation in Montana, and recent adverse citizen responses to proposed tax increases by local government, would suggest that the public may not be receptive to the use of this funding alternative.

Tax Increment Financing (TIF)

Increment financing has been used in many municipalities to generate revenue for public improvements projects. As improvements are made within the district, and as property values increase, the incremental increases in property tax revenue are earmarked for this fund. The fund is then used for improvements within the district. Expenditures of revenue generated by this method are subject to certain spending restrictions and must be spent within the district. Tax increment districts could be established to accomplish transportation improvements in other areas of the community where property values may be expected to increase. A TIF is currently being utilized in downtown Bozeman. Additional TIF districts could be established in other areas of the city and county to accomplish a variety of transportation-related improvements.

Multi-Jurisdictional Service District

This funding option was authorized in 1985 by the State Legislature. This procedure requires the establishment of a special district, somewhat like an SID or RSID, which has the flexibility to extend across city and county boundaries. Through this mechanism, an urban transportation district could be established to fund a specific highway improvement that crosses municipal boundaries (e.g., corporate limits, urban limits, or county line). This type of fund is structured similar to an SID with bonds backed by local government issued to cover the cost of a proposed improvement. Revenue to pay for the bonds would be raised through assessments against property owners in the service district.

Local Improvement District

This funding option is only applicable to counties wishing to establish a local improvement district for road improvements. While similar to an RSID, this funding option has the benefit of allowing counties to initiate

a local improvement district through a more streamlined process than that associated with the development of an RSID.

5.4. Future Potential Funding Sources

Local Sales Tax

If authorizing legislation were to be approved, local governments would be able to initiate local option taxes as a potential funding source for transportation improvements. One local option tax would be a local sales tax.

Wheel Tax

If initiated, a tax per wheel on vehicles licensed in counties could generate substantial revenue. The cost to each user of the transportation network would be proportional to the number and type of vehicles owned.

Local Option Motor Fuel Tax

A local option fuel tax is another means of raising revenue for the construction, reconstruction, maintenance, and repair of public streets and roads. This local tax may be imposed by the people of the county or by the adoption of a resolution by the county commissioners and referred to the people. An advantage to a local motor fuel tax, as with a wheel tax, is that it taxes only the users of the transportation system and the tax paid by each individual is directly proportional to their use of the facilities. The revenue from a motor fuel tax must be distributed proportionately among the county and its member municipalities based on vehicle registration.

Excise Taxes

Excise taxes are similar to sales taxes with the exception that items taxed are those considered to be indulgent. The demand for items on which there is an excise tax is generally large, therefore, there is potential to raise a substantial amount of local revenue. Products on which an excise tax could be imposed for additional local revenue include such items as tobacco, alcohol, and various forms of entertainment. A potential problem with excise taxes arises when the tax causes inter-area competition.

Development Impact Fees

Another method funds can be generated for transportation improvements is by assessing a fee to the developers of property based upon the impact the development is likely to have on the transportation network.

Value Capture Taxes

Value capture taxes are a means of raising revenue following the development of transportation improvements. Whereas development fees are assessed to make necessary transportation improvements, value capture taxes impose a fee to businesses which benefit due to their location along improved, highly traveled routes, which assumes improvements have been made. Value capture taxes may be a means to enter into other forms of funding future improvements. One method to consider would be cash flow management that makes wise use of existing revenue rather than continuing to introduce new sources.

6.0 SUMMARY OF CURRENT FINANCIAL STATUS

Current financial information was obtained from the MDT Statewide and Urban Planning Section to get a picture of the projected revenue available for funding transportation projects in the Great Falls area over the next 20 years. This information is summarized in **Table 2**.

Table 2: Projected Funding (Estimated) by Funding Source in YOE Dollars

Funding Source	FFY 2018 Beginning Balance	Expected Allocation					2018-2022 Expected Funding	Average Funding Received	2023-2038 Projected Funding	Total Funding (2018-2038)
		2018	2019	2020	2021	2022				
FEDERAL										
NHPP	**$0**	**$2,721,266**	**$5,957,071**	**$4,592,277**	**$1,557,071**	**$1,557,071**	**$16,384,756**	**$1,557,071**	**$23,356,065**	**$39,740,821**
IM	*$0*	*$ 621,450*	*$500,000*	*$3,535,206*	*$500,000*	*$500,000*	*$5,656,656*	*$500,000*	*$7,500,000*	*$13,156,656*
NH	*$0*	*$1,057,071*	*$5,457,071*	*$1,057,071*	*$1,057,071*	*$1,057,071*	*$9,685,355*	*$1,057,071*	*$15,856,065*	*$25,541,420*
NHPB	*$0*	*$1,042,745*	*$0*	*$0*	*$0*	*$0*	*$1,042,745*	*$0*	*$0*	*$1,042,745*
STP	**$3,371,163**	**$2,760,259**	**$4,267,689**	**$2,657,409**	**$2,657,409**	**$2,657,409**	**$18,371,338**	**$2,657,409**	**$39,861,135**	**$58,232,473**
STPU	*$3,371,163*	*$1,430,409*	*$1,430,409*	*$1,430,409*	*$1,430,409*	*$1,430,409*	*$10,523,208*	*$1,430,409*	*$21,456,135*	*$31,979,343*
UPP	*$0*	*$577,850*	*$2,069,979*	*$500,000*	*$500,000*	*$500,000*	*$4,147,829*	*$500,000*	*$7,500,000*	*$11,647,829*
Set-aside (TA) - City	*$0*	*$225,000*	*$240,301*	*$200,000*	*$200,000*	*$200,000*	*$1,065,301*	*$200,000*	*$3,000,000*	*$4,065,301*
Set-aside (TA) - County	*$0*	*$527,000*	*$527,000*	*$527,000*	*$527,000*	*$527,000*	*$2,635,000*	*$527,000*	*$7,905,000*	*$10,540,000*
HSIP	**$0**	**$200,000**	**$284,000**	**$2,202,310**	**$200,000**	**$200,000**	**$3,086,310**	**$200,000**	**$3,000,000**	**$6,086,310**
CMAQ	**$6,473,653**	**$2,197,317**	**$2,772,117**	**$2,317,417**	**$2,039,717**	**$2,039,717**	**$17,839,938**	**$2,039,717**	**$30,595,755**	**$48,435,693**
CMAQ- Formula	*$6,473,653*	*$1,539,717*	*$1,539,717*	*$1,539,717*	*$1,539,717*	*$1,539,717*	*$14,172,238*	*$1,539,717*	*$23,095,755*	*$37,267,993*
MACI	*$0*	*$657,600*	*$1,232,400*	*$777,700*	*$500,000*	*$500,000*	*$3,667,700*	*$500,000*	*$7,500,000*	*$11,167,700*
Transit Capital Operating Assistance Funding	**$0**	**$2,904,000**	**$2,865,000**	**$2,865,000**	**$2,865,000**	**$2,865,000**	**$15,446,000**	**$2,865,000**	**$42,975,000**	**$58,421,000**
STATE AND LOCAL										
TransADE	**$0**	**$39,600**	**$39,600**	**$39,600**	**$39,600**	**$39,600**	**$198,000**	**$39,600**	**$594,000**	**$792,000**
Operations and Maintenance	**$0**	**$2,179,000**	**$2,179,000**	**$2,179,000**	**$2,179,000**	**$2,179,000**	**$10,895,000**	**$2,179,000**	**$32,685,000**	**$43,580,000**
State	*$0*	*$1,652,000*	*$1,652,000*	*$1,652,000*	*$1,652,000*	*$1,652,000*	*$8,260,000*	*$1,652,000*	*$24,780,000*	*$33,040,000*
County	*$0*	*$50,000*	*$50,000*	*$50,000*	*$50,000*	*$50,000*	*$250,000*	*$50,000*	*$750,000*	*$1,000,000*
City	*$0*	*$477,000*	*$477,000*	*$477,000*	*$477,000*	*$477,000*	*$2,385,000*	*$477,000*	*$7,155,000*	*$9,540,000*
State Fuel Tax	**$0**	**$1,166,441**	**$1,166,441**	**$1,166,441**	**$1,166,441**	**$1,166,441**	**$5,832,205**	**$1,166,441**	**$17,496,615**	**$23,328,820**
City	*$0*	*$968,588*	*$968,588*	*$968,588*	*$968,588*	*$968,588*	*$4,842,940*	*$968,588*	*$14,528,820*	*$19,371,760*
County	*$0*	*$197,853*	*$197,853*	*$197,853*	*$197,853*	*$197,853*	*$989,265*	*$197,853*	*$2,967,795*	*$3,957,060*
HB473 Gas Tax Funds (BaRSSA)	**$0**	**$433,167**	**$433,167**	**$433,167**	**$433,167**	**$433,167**	**$2,165,835**	**$433,167**	**$6,497,505**	**$8,663,340**
City	*$0*	*$360,411*	*$360,411*	*$360,411*	*$360,411*	*$360,411*	*$1,802,055*	*$360,411*	*$5,406,165*	*$7,208,220*
County	*$0*	*$72,756*	*$72,756*	*$72,756*	*$72,756*	*$72,756*	*$363,780*	*$72,756*	*$1,091,340*	*$1,455,120*
TOTAL	$9,844,816	$14,601,050	$19,964,085	$18,452,621	$13,137,405	$13,137,405	$90,219,382	$13,137,405	$197,061,075	$287,280,457

Notes: Although FAST Act only provides for Federal funding through Federal FY 2020, projections through 2038 are based on continuance of current levels of funding unless otherwise noted. It is important to note that the projected funding estimates are based on the best information available at this time and that there is no guarantee that these funding sources will be available beyond FAST Act. Estimated Federal fund allocations do not include amounts of any required local matching funds. Federal revenues, local revenues and local and state matching funds are held constant and do not inflate over time due to uncertainty with federal transportation program reauthorization. Accordingly, future year allocation for years 2022-2028 are based on current average annual allocations, as seen in the Great Falls TIP 2018-2022, being projected out to the future. Reevaluation of revenue estimation may be necessary as part of a future LRTP update.

7.0 FISCAL CONSTRAINT

FAST Act requires that the cost of all projects in the LRTP must be estimated using inflated Year of Expenditure (YOE) dollars in order to provide a consistent and equivalent comparison of project costs to available revenue. Converting all costs to YOE dollars theoretically presents a more accurate picture of costs when compared to revenues, and identifies potential deficits associated with the LRTP. To provide for such a comparison, the total costs of committed projects, and the total costs of committed + recommended projects, were correlated to anticipated total revenue available through the year 2038. The portrayal of estimated costs against potential revenue throughout the life of the LRTP is a requirement of fiscal constraint. Initial project cost estimates were calculated in 2018 dollars and subsequently inflated to YOE dollars using a three percent annual inflation factor.

Due to funding requirements and jurisdictional boundaries, transportation financing is somewhat compartmentalized. Because of this, it is necessary to evaluate each project, and identify the most likely funding programs to finance each project.

For a "planning level" document such as this LRTP, it is not reasonable to assign priorities to the actual projects being recommended in the Plan. Project prioritization is a function of the transportation planning process, however, and the Transportation Advisory Committee acts in that capacity through advancing projects forward into the Transportation Improvement Program (TIP). The information from the 2018-2022 TIP is reflected in this memorandum.

7.1. Funding of Committed Projects

The committed improvement projects, as found in the 2018-2022 TIP, have been subdivided according to a likely funding source and are presented in **Table 3**.

Table 3: Committed Projects

ID	Name	Description	Funding Source	YOE*	Estimated Cost**
C1	**Fox Farm Road - East Fiesta to Dick Road (UPN 8193)**	Reconstruct to rural arterial roadway standards	STPU	2018	$3,546,459
C2	**Bridge Preservation - Great Falls 2014 (UPN 8085)**	Overlay bridge decks over the railroad on I-315 between Fox Farm and 10th Ave S	NHPB	2018	$1,042,745
C3	**14th St SW Signals – GF (UPN 9572)**	Retime signals at three locations (16th Ave SW, 14th St SW & Ramp, and Market Place Dr)	MACI/CMDP	2018	$32,000
C4	**NW Bypass Signals - Great Falls (UPN 9573)**	Retime signals at two locations (6th St NW and 9th St NW)	MACI/CMDP	2018	$25,600
C5	**Transit Operating Expense**	General transit operating expenses	FTA 5311	2018	$39,000
C6	**Transit Capital purchase**	Aquire vehicles and related equipment	CMAQ	2018	$884,000
C7	**Great Falls – North (UPN 7625)**	Reconstruct and widen US-87 with passing and turn lanes	NH	2020	$4,400,000
C8	**Great Falls South – Urban (UPN 9511)**	Pavement preservation- overlay (Lower River Rd, 55th Ave S and 13th St S)	UPP	2018	$77,850
				2019	$1,569,979
C9	**3rd St NW - Great Falls (UPN 9053)**	New signal upgrades with flashing yellow left turns and ADA ramps (3rd St SW / Smelter Ave)	MACI/CMDP	2018	$100,000
				2019	$709,400
C10	**SF 169 Cascade Cnty SFTY Imprv**	Countywide safety improvements to address road departure crashes at two locations Lower River Rd/13th St S	HSIP	2019	$84,000
C11	**Park Dr/4th Ave N Ped Xing- GTF Bike/Ped (UPN 9148)**	Bicycle and pedestrian crossing	TA	2018	$25,000
				2019	$240,301
C12	**2nd Ave N Signals – GF (UPN 9530)**	Signal upgrades at four locations, (3rd St, 4th St, 5th St, and 6th St)	MACI/CMDP	2019	$23,000

ID	Name	Description	Funding Source	YOE*	Estimated Cost**
C13	**SF139 - 6th St / NW Bypass Sfty (UPN 8623)**	Offset of left turn lanes and upgrade signals and ADA ramps	MACI/CMDP	2020	$277,700
			HSIP		$212,000
C14	**SF169 I-15 HT Cable Rail (UPN 9376)**	High tension median barrier rail b/w Vaughn and Central Ave W	HSIP	2020	$1,790,310
C15	**Ulm- Great Falls (UPN 9589)**	Pavement Preservation on Ulm Frontage Road from Ulm to Gore Hill Interchange	IM	2018	$44,800
				2020	$1,655,522
C16	**Fox Farm Road - West (I-315) (UPN 9590)**	Pavement Preservation on I-315 from Fox Farm to I-15	IM	2018	$76,650
				2020	$1,379,684
C17	**Stuckey Road (UPN 9532)**	Pave gravel road, improve to rural standards within City Limits	CMAQ	2021	$605,000
				TOTAL COMMITTED PROJECTS	$18,841,000

Most projects are split into multiple phases of development (design, right-of-way, utilities, and construction). Phases occur over multiple years. The Year of Expenditure (YOE) reflects the year that funds are spend for any given phase of the project.
***These costs reflect the portion of the project which the Great Falls Area MPO is responsible for, as per the Great Falls 2018-2022 TIP.*

7.2. Funding of Annual Programs

Annual allocations for various programs are identified in the Great Falls 2018-2022 TIP. These programs are included to account for typical annual expenditures that are typically less costly and more routine than stand-alone projects. An estimate of annual costs was also made for years beyond those identified in the TIP (2023-2038). Funding for these programs is not guaranteed and is determined on a case-by-case basis. Specific projects have yet to be identified for these programs. These programs are intended to identify funding needs for routine annual projects.

Table 4: Anticipated Annual Programs

ID	Name	Description	Funding Source	YOE	Estimated Cost
P1	Durable Pavement Markings Program	Install markings on Urban routes per City, County, and MDT	STPU	2018-2022	$250,000
				2023-2038	$750,000
P2	Urban System Maintenance Program (Local)	Perform chip seals, overlays and related maintenance activities on Urban Routes	STPU	2018-2022	$928,090
				2023-2038	$2,625,000
P3	Operations & Maintenance- Local	Operate and maintain federal-aid systems	O&M- state	2018-2022	$8,260,000
				2023-2038	$22,500,000
			O&M- Local	2018-2022	$2,635,000
				2023-2038	$7,500,000
P4	Traffic Mitigation	Complete projects that help mitigate traffic congestion	MACI-Discretionary	2018-2022	$1,250,000
				2023-2038	$3,750,000
P5	ADA Compliance	Complete projects that help make the transportation system compliant with the Americans with Disabilities Act	MACI-Discretionary	2018-2022	$1,250,000
				2023-2038	$3,750,000
P6	Transportation Alternatives Projects	Complete non-motorized transportation projects or other eligible Transportation Alternatives projects	TA	2018-2022	$1,000,000
				2023-2038	$3,000,000
P7	Transit Operating Expense	General transit operating expenses	FTA Sect 5307	2018-2022	$14,325,000
				2023-2038	$42,975,000
P8	Transit Capital purchase	Acquire vehicles and related equipment	TransADE	2018-2022	$198,000
				2023-2038	$594,000
P9	MDT-nominated HSIP Safety Projects	Safety improvement projects	HSIP	2018-2022	$1,000,000
				2023-2038	$2,250,000
P10	MDT-nominated Pavement Preservation Projects	Mill, overlay, seal & cover, chip seal, striping	NHPP	2018-2022	$7,785,355
				2023-2038	$22,500,000

ID	Name	Description	Funding Source	YOE	Estimated Cost
P11	City Pavement Preservation Activities	Mill, overlay, seal & cover, chip seal, striping	UPP	2018-2022	$2,500,000
				2023-2038	$7,500,000
				ANNUAL PROGRAM TOTAL	$161,075,445

7.3. Funding of Recommended Projects

The recommended improvements are listed in the *Facility Recommendations Memorandum*. The projects typically allow maximum flexibility by the local government in implementing the various improvements. Assigning priority for the recommended projects is complicated by the fact that the State, city, and county all maintain jurisdiction over various portions of the street network where projects are proposed. Therefore, each of these entities may have separate priorities for implementing projects under their respective jurisdictions. Recommended improvement projects are summarized and shown in **Table 4**.

Table 5: Recommended Projects

ID	Name	Description	Funding Source	YOE	Estimated Cost
R1	River Drive N – 15th St N to 25th St N	Reconstruct to three-lane arterial and improvements to 25th St N intersection	NHPP	Beyond 2022	$7,500,000
			HSIP		$3,000,000
			MACI		$3,000,000
			STPU		$1,000,000
R2	Fox Farm Intersection Improvements	Install dual eastbound left-turn lanes	MACI	Beyond 2022	$100,000
R3	Signal Modifications/Upgrades/Roundabout Control	Upgrade all signal heads in the City	MACI	Beyond 2022	$270,000
R4	Central Avenue W – 3rd St NW to 1st Ave N	Restriping and intersection modifications	NHPP	Beyond 2022	$867,000
R5	26th Street S – 24th Ave S to 33rd Ave S	Flatten fill slopes on 26th St S and install 4-way stop control at intersection of 26th St S and 33rd Ave S	COUNTY	Beyond 2022	$478,000
R6	Central Avenue / 9th Street Intersection	Modify intersection	MACI	Beyond 2022	$17,000
R7	25th Street S – 10th Ave S to 11th Ave S	Modify to one-way in southbound direction	STPU	Beyond 2022	$23,000
R8	25th Avenue NE – Old Havre Hwy to 15th St N	Several improvements to improve safety and operations	STPU	Beyond 2022	$338,000
R10	Emerson Junction Feasibility Study	Secure local project sponsor to fund an operational analysis/feasibility study of the interchange	CITY	Beyond 2022	$250,000
R11	Gore Hill Interchange with Southbound Auxiliary Lane	Install additional traffic control at interchange and construct southbound auxiliary lane	NHPP	Beyond 2022	$4,750,000
			HSIP		$2,250,000
			MACI		$2,400,000
			NHPB		$1,500,000
R12	Fox Farm Road – Alder Dr to Park Garden Rd	Restripe to four-lane facility	STPU	Beyond 2022	$810,000
R13	Giant Springs Road – Hatchery to Rainbow Dam	Overlay with new asphalt and widen	UPP	Beyond 2022	$3,377,000
R14	9th Street NW – NW Bypass to Central Ave W	Reconstruct to collector	STPU	Beyond 2022	$5,177,000
				TOTAL RECOMMENDED PROJECTS	$37,107,000

Considerations for setting priorities for the recommended projects would include safety, cost of the project, availability of alternate funding, availability of right-of-way, ease of implementation, and community interest. Implementation of the projects, beginning with the projects that have the greatest need and available financing, will continue until all projects are completed.

Recommended projects within the MDT-nominated preservation and HSIP categories do not rise to regional significance and would be exempt from air quality conformity. Individual projects implemented in the TIP selection process will draw from these categories. Funding for these projects have not been allocated to specific projects so the estimates are based upon historical averages.

No aspect of addressing facility improvements will demand more creativity and flexibility than that of project financing. Local governments will be required to be aware of changes in funding sources and of new sources. Local governments should, at all times, be mindful of the following considerations regarding the financing:

- Numerous conventional methods of financing improvements are available to local government (bonds and Special Improvement Districts, for example). Such obvious methods should not be overlooked.
- Financing for special types of projects sometimes are available. Currently, funding is available for certain kinds of safety projects, and projects for bicycle facilities and walking trails.
- Local government should attempt to link private beneficiaries of SR improvements with private sources of financing. Further, in the event that private individuals come forward with funding, local government should be prepared to accept it.

7.4. Funding of Non-Motorized Projects

There is one specific non-motorized project that is committed, the Park Dr & 4th Ave N pedestrian crossing. Because the LRTP presents a visionary network for the non-motorized transportation system, it is likely that improvements will coincide with roadway projects as they are developed. Accordingly, the network will be built over time. Non-motorized projects are not "recommended projects" in the conventional sense, however should be developed as time and funding allows. Non-motorized network recommendations in this LRTP should be consulted any time a road or intersection project is being programmed. Most, if not all, of the funding sources previously mentioned can be used to contribute to non-motorized improvements, either as part of an overall project or as a stand-alone project.

Historically, by examining the information contained in the TIP it can be seen that approximately $7 Million has been expended on non-motorized projects between 2013 and 2019 – a period of 6 years. This amounts to an annual expenditure of roughly $1.16 Million per year. This expenditure can be thought of as an annual program necessary and dedicated to non-motorized infrastructure.

7.5. Funding of Transit Projects

As seen in the recommendations, there are no specific committed improvement projects for the transit system, there are only annual funding allocations that contribute to the acquisition of new vehicles and related equipment over the years. Historically, Great Falls Transit has attempted to replace four older busses on a 4-year cycle. It is envisioned that this would continue over the course of the LRTP planning horizon as funds are available.

7.6. Funding Summary

A comparison of the estimated costs for the various transportation categories, and the potential revenue from sources most likely to be used to fund the various projects, confirms that the LRTP is fiscally constrained over the 20-year life of the Plan (see **Table 5**). The revenue available is more than the anticipated costs.

Table 6: Comparison of LRTP Estimated Costs and Available Revenue (Planning Year 2038)

Funding Source	2018-2022			2023-2038		
	Anticipated Funding*	Expenditures	Difference	Projected Funding**	Expenditures	Difference
FEDERAL						
National Highway Performance Program	**$16,384,756**	**$16,384,756**	**$0**	**$38,835,795**	**$37,117,000**	**$1,718,795**
Interstate Maintenance (IM) and National Highway (NH)	*$15,342,011*	*$15,342,011*	*$0*	*$35,625,000*	*$35,617,000*	*$8,000*
National Highway Performance Bridge (NHPB)	*$1,042,745*	*$1,042,745*	*$0*	*$3,210,795*	*$1,500,000*	*$1,710,795*
Surface Transportation Program	**$15,936,338**	**$10,137,679**	**$5,798,659**	**$42,534,105**	**$24,600,000**	**$23,732,764**
Surface Transportation Program Urban Highways (STPU)	*$10,523,208*	*$4,724,549*	*$5,798,659*	*$21,456,135*	*$10,723,000*	*$16,531,794*
Urban Pavement Preservation Program (UPP)	*$4,147,829*	*$4,147,829*	*$0*	*$18,077,970*	*$10,877,000*	*$7,200,970*
*Set-aside Program - Transportation Alternatives (TA)***	*$1,265,301*	*$1,265,301*	*$0*	*$3,000,000*	*$3,000,000*	*$0*
Highway Safety Improvement Program (HSIP)	**$3,086,310**	**$3,086,310**	**$0**	**$7,500,000**	**$7,500,000**	**$0**
Congestion Mitigation and Air Quality Improvement Program (CMAQ)	**$17,030,538**	**$4,347,300**	**$12,683,238**	**$41,403,870**	**$13,287,000**	**$29,991,993**
Montana Air and Congestion Initiative (MACI) - Guaranteed Program	*$14,172,238*	*$1,489,000*	*$12,683,238*	*$23,095,755*	*$5,787,000*	*$29,991,993*
*Montana Air and Congestion Initiative (MACI) - Discretionary Program****	*$2,858,300*	*$2,858,300*	*$0*	*$18,308,115*	*$7,500,000*	*$0*
Federal Transit Authority (FTA) Funds	**$14,364,000**	**$14,364,000**	**$0**	**$42,975,000**	**$42,975,000**	**$0**
STATE AND LOCAL						
TransADE	**$198,000**	**$198,000**	**$0**	**$594,000**	**$594,000**	**$0**
Operations and Maintenance	**$10,895,000**	**$10,895,000**	**$0**	**$32,685,000**	**$30,000,000**	**$2,685,000**
State	*$8,260,000*	*$8,260,000*	*$0*	*$24,780,000*	*$22,500,000*	*$2,280,000*
County	*$2,635,000*	*$2,635,000*	*$0*	*$7,905,000*	*$7,500,000*	*$405,000*
State Fuel Tax****	**$5,832,205**	**$0**	**$5,832,205**	**$17,496,615**	**$5,343,000**	**$22,600,820**
City	*$4,842,940*	*$0*	*$4,842,940*	*$14,528,820*	*$250,000*	*$19,121,760*
County	*$989,265*	*$0*	*$989,265*	*$2,967,795*	*$478,000*	*$3,479,060*
HB473 Gas Tax Funds (BaRSSA)****	**$2,165,835**	**$0**	**$2,165,835**	**$6,497,505**	**$0**	**$8,663,340**
City	*$1,802,055*	*$0*	*$1,802,055*	*$5,406,165*	*$0*	*$7,208,220*
County	*$363,780*	*$0*	*$363,780*	*$1,091,340*	*$0*	*$1,455,120*
TOTAL	$85,892,982	$59,413,045	$26,479,937	$219,713,775	$156,801,000	$89,392,712

**2018-2022 Expected Funding is per the Great Falls Transportation Improvement Program FY 2018-2022.*
***2023-2038 Projected Funding is estimated based on past funding levels and is the best information available at this time. There is no guarantee that funding will be available in the future.*
****TA funds are allocated through a competitive process. Funding is not guaranteed and is dependent on availability.*
*****Great Falls does not receive an annual allocation of MACI Discretionary funding. Funding is allocated based on need and is not guaranteed.*

Illustrative projects do not have definite funding sources within the timeframe of the Plan. Therefore, these projects are not included in the summary for the purposes of fiscal constraint. As agencies review needs, identify new funding sources and plan projects, the long-range project list should be used as a guide for new projects.

By viewing the financial summary above and the projects recommendations, it is clear that it will be important to clearly identify the projects that are considered to have the highest priority through the already established Transportation Improvement Program (TIP) and Capital Improvement Program (CIP) processes. The mechanism for doing this is already in place through the Technical Advisory Committee (TAC) and the Policy Coordinating Committee (PCC).

This LRTP is fiscally responsible in that traditional funding programs, targeted to be utilized for the majority of the projects within the Great Falls area, are identified, available and likely to be funded at current or slightly smaller levels than in past years.

7.7. Evaluation of Projects and Programs

Actively pursuing the advance acquisition of rights-of-ways needed for future extensions of already existing roadways is essential to the community as development occurs to the outlying areas. The majority of the recommended improvements developed through this LRTP Update will be able to work within the already established right-of-way corridors. If the property necessary for a low priority improvement, however, does become available prior to the time local government has scheduled the improvement, consideration should be given to changing the project's priority and acquiring the right-of-way at today's lower costs.

The following are additional considerations relating to right-of-way acquisitions:

- Focus on key landowners and work to maintain favorable relations with them. In some instances, particularly in situations in which there is a perception that property will be difficult to obtain, local government should attempt to initiate a negotiation process with the landowner as soon as possible.
- Do not rule out entering into agreements with landowners that may produce a benefit in the long-term. For instance, the local government may be aware of property it will require for future improvement. At present, local government may not have funds available for acquisition, and the landowner may not wish to sell. Nonetheless, by entering into an agreement for first right of refusal, local government can be in a better position to acquire the property in the future, when it may be in a more favorable financial situation.
- Local government can exert considerable influence on the development (or lack thereof), of property which may potentially be required by the community for transportation improvement purposes. Zoning, subdivision, and condemnation powers should not be overlooked particularly in right-of-way matters.

Obviously, another major difficulty in completing most of the major improvement projects will be that of securing financing. Project funding from the traditional public sources will likely be unavailable for many recommended improvements. However, in analyzing each improvement, it may be determined that a private party would benefit significantly from the project. In such a case, private dollars should be used as a match to secure public funds, or to fund the entire project. Therefore, in considering the prioritization of improvements, it is essential for local government to remain flexible and take advantage of financing opportunities as they arise.

The following recommendations present general guidelines for performing financial planning and increasing funding availability for project development and implementation.

- A coherent financial plan is necessary. Both the City and the County should continue to develop five-year Capital Improvement Programs (CIP's) and the Transportation Improvement Program (TIP). The CIP's and the TIP are the principal documents that outline the projects to be completed in the immediate future. These plans must include an analysis of all available sources of financing and link major network improvements to identified sources of financing.
- Matching funds can be a tremendous benefit to the local government. A consideration of matching funds should play a significant role in financial planning. Projects that have matching dollars available should be given a high priority. The City, County and State governments should work to develop new sources of matching funds.
- Financial planning should emphasize that in special cases, private dollars might be available to undertake a project. In such a case, the source of funding must be identified as a direct beneficiary of the project. The local government should bear in mind that such funding could provide the match necessary to receive State or Federal funds.

- Projects should be managed for efficiency and reductions in design and other pre-construction costs should be actively pursued. Incidental project costs such as the State's ICAP takes needed federal funds away from construction and drains scarce local funds. Local governments should look for ways to eliminate this burden, and the State should actively pursue other, more appropriate methods for funding its operating costs that do not take from funding categories needed for local projects.

Finally, in undertaking major network improvements, the local government should be aware of opportunities for constructing projects in separate phases. Often, funding is simply not available to address an improvement in its entirety. In such cases, a great deal can be accomplished by tackling separate components of individual improvements over the long term, such division of effort should not include separating bicycle and pedestrian facilities from initial street construction.

APPENDIX I:
Performance Measures and Targets



PERFORMANCE MEASURES AND TARGETS

April 16, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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PERFORMANCE MEASURES AND TARGETS

1.0 BACKGROUND

The *Fixing America's Surface Transportation (FAST) Act* was passed by Congress and signed into law on December 4, 2015. The bill replaces the *Moving Ahead for Progress in the 21st Century* (MAP-21) federal legislation that was in place during the 2014 LRTP. MAP-21 included provisions to create a surface transportation program that is more streamlined, performance-based, and multimodal. MAP-21 addressed challenges like improving safety, maintaining infrastructure condition, reducing traffic congestion, improving the efficiency of the system and freight movement, protecting the environment, and reducing delays in project delivery. MAP-21 transformed the Federal-aid highway program and the Federal transit program by establishing new requirements for performance management to help ensure the most efficient investment of Federal transportation funds.

Performance management is a strategic, structured approach intended to improve project and program delivery, inform investment decision-making, and increase transparency and accountability to the public. MAP-21 built upon the framework of previous federal transportation planning processes by requiring State departments of transportation (DOTs), Metropolitan Planning Organizations (MPOs), and operators of public transportation to link investment priorities to the achievement of performance targets for key areas, including safety, infrastructure condition, congestion, system reliability, emissions, and freight movement.

The FAST Act left many of the provisions from MAP-21 intact, and continues MAP-21's overall performance management approach. As part of the required performance-based approach, statewide and metropolitan transportation planning processes must use a performance-based approach to decision-making in support of the national goal areas found in 23 U.S.C. 150(b) and the general purposes described in 49 U.S.C. 5301:

- **Safety** - To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- **Infrastructure Condition** - To maintain the highway infrastructure asset system in a state of good repair.
- **Congestion Reduction** - To achieve a significant reduction in congestion on the NHS.
- **System Reliability** - To improve the efficiency of the surface transportation system.
- **Freight Movement and Economic Vitality** - To improve the national highway freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
- **Environmental Sustainability** - To enhance the performance of the transportation system while protecting and enhancing the natural environment.
- **Reduced Project Delivery Delays** - To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

MAP-21 and the FAST Act establish a strong linkage between performance measures and performance targets. These measures and targets are connected through transportation plans and programs developed at the statewide level and locally for metropolitan areas. State DOTs and MPOs are responsible for setting performance targets for national performance measures, as well as any additional measures desired to support local priorities. In accordance with Federal law, the US Department of

Transportation (USDOT) is responsible for identifying performance measures related to national highway and transit performance goals that States and MPOs must establish performance targets for. With these national goals as a baseline, State DOTs and MPOs may identify additional performance measures and targets that address local community visions and goals.

Performance-based planning incorporates specific performance measures and targets into existing transportation planning and programming processes. The process relies on the development of a strategic direction defined by identified goals, objectives, and performance measures which will guide future planning and decision-making. Performance-based long-range plans identify trends and targets; define strategies; analyze alternatives; and develop investment priorities. Long-range transportation plans are linked to a transportation improvement program (TIP) for MPO areas or statewide transportation improvement program (STIP) to identify and deliver projects that improve performance and achieve targets according to the established strategic direction. Monitoring the performance and results of projects and programs helps evaluate success and provide information that informs future planning efforts.

2.0 PERFORMANCE MEASURES AND TARGETS

Performance measures are essential elements of a performance-based planning process. Performance measures are derived from the goals and objectives of the transportation planning process and provide metrics that can be used to assess progress toward meeting the identified goals and objectives. How performance is defined and measured can significantly affect the types of projects and strategies that are advanced through the planning process by decisionmakers.

Performance measures serve a variety of important purposes within performance-based planning and programming processes including:

- Defining metrics for achievement of goals for the transportation system;
- Providing metrics to track the performance and overall effectiveness of transportation projects or strategies over time;
- Helping define performance targets; and
- Providing a consistent basis for comparing alternative investments or policies to make better decisions.

While a performance measure itself provides a metric for comparison, a performance-based planning approach requires the identification of a desired trend (direction of results) or target (specific level of performance to be achieved within a certain timeframe) for each measure to track the performance of projects and strategies and analyze their effectiveness. Performance targets may be directional (e.g., reduce, increase, maintain), aspirational (reflecting a broad objective), or specific numerical targets (e.g., annual reduction in the number of fatalities or incapacitating injuries). Targets must be realistic and achievable.

Implementing performance targets implies sufficient baseline data exists to quantify past trends and/or agencies are willing to commit the time and resources necessary to collect data that can be used to monitor performance and inform future transportation decision-making.

2.1. National Performance Measures

The USDOT is responsible for establishing the performance measures that will be used to assess progress in three apportioned Federal-aid programs including: the National Highway Performance Program (NHPP); the Highway Safety Improvement Program (HSIP); and the Congestion Management and Air Quality (CMAQ) program.

As required by the MAP-21 and FAST Act, the USDOT has implemented performance requirements by adopting a series of rules that establish a set of performance measures for use by State DOTs and MPOs. The rules serve to implement the performance management framework called for in MAP-21 and the FAST Act. Considered together, these recent regulations provide measures to effectively evaluate and track the performance of transportation systems across the Nation. State DOTs and MPOs are expected to use the information and data generated as a result of these new regulations to inform their own transportation planning and programming decisions.

In accordance with 23 U.S.C. 150(c), the Federal Highway Administration (FHWA) established the following measures to assess transportation system performance:

1. Serious injuries per vehicle miles traveled (VMT).
2. Fatalities per VMT.
3. Number of serious injuries.
4. Number of fatalities.
5. Number of combined non-motorized fatalities and non-motorized serious injuries.
6. Pavement condition on the Interstate System.
7. Pavement condition on the non-Interstate National Highway System (NHS).
8. Bridge condition on the NHS.
9. Traffic congestion.
10. On-road mobile source emissions.
11. Freight movement on the Interstate System.
12. Performance of the Interstate System.
13. Performance of the non-Interstate NHS.
14. The percentage of non-revenue, support-service and maintenance vehicles that have either met or exceeded their useful life benchmark (ULB).
15. The percentage of rolling stock vehicles that have either met or exceeded their ULB.
16. The percentage of track segments with performance restrictions for rail fixed guideway, track, signals, and systems.
17. The percentage of facilities rated below condition 3 on the Transit Economic Requirements Model (TERM) scale.

2.1.1. Highway Safety Improvement Program and Safety Performance Management Final Rules

Under the *Highway Safety Improvement Program (HSIP) and Safety Performance Management Measures Final Rules*[1], which became effective on April 16, 2014, FHWA established five performance measures to carry out the HSIP and to assess serious injuries and fatalities on all public roads. In addition, the rule establishes the process for State DOTs and MPOs to establish and report their safety targets and progress made in meeting their safety targets, and the process FHWA will use to assess whether State DOTs have met or made significant progress toward meeting safety targets. The five performance measures to assess performance and carry out the HSIP established in the rule include:

- Number of fatalities;
- Rate of fatalities per VMT;
- Number of serious injuries;

[1] Final Rule on “National Performance Management Measures: Highway Safety Improvement Program": Docket No. FHWA–2013–0020, RIN 2125–AF49, Federal Register - RIN 2125–AF49 Vol. 81, No. 50, Pg. 13882 - March 15, 2016: https://www.gpo.gov/fdsys/pkg/FR-2016-03-15/pdf/2016-05202.pdf.

- Rate of serious injuries per VMT; and
- Number of combined non-motorized fatalities and non-motorized serious injuries.

2.1.2. Pavement and Bridge Condition Performance Measures Final Rule

FHWA established performance measures to assess pavement and bridge conditions on the Interstate System and non-Interstate NHS in the *Pavement and Bridge Condition Performance Measures Final Rule*[2], which became effective on May 20, 2017. Four measures were adopted to assess pavement condition:

- Percentage of pavements on the Interstate System in Good condition;
- Percentage of pavements on the Interstate System in Poor condition;
- Percentage of pavements on the NHS (excluding the Interstate System) in Good condition; and
- Percentage of pavements on the NHS (excluding the Interstate System) in Poor condition.

The two performance measures for assessing bridge condition adopted under the rule include:

- Percentage of NHS bridges classified as in Good condition; and
- Percentage of NHS bridges classified as in Poor condition.

The final rule applies to all bridges carrying the NHS, including bridge on- and off-ramps connected to the NHS.

2.1.3. System Performance/Freight/CMAQ Performance Measures Final Rule

The *System Performance/Freight/CMAQ Performance Measures Final Rule*[3] establishes performance measures that State DOTs and MPOs will use to report on the performance of the Interstate and non-Interstate NHS; freight movement on the Interstate system to carry out the National Highway Freight Program (NHFP); and traffic congestion and on-road mobile source emissions to carry out the CMAQ Program. The final rule became effective on May 20, 2017, except for portions of the rule related to the Greenhouse Gas (GHG) measure (the percent change in tailpipe CO_2 emissions on the NHS compared to the calendar year 2017 level). On October 5, 2017, the FHWA published a notice of proposed rulemaking to repeal of the GHG measure. FHWA plans to issue a Final Rule in Spring 2018 announcing its decision on whether to repeal, retain, or revise the GHG measure.

The following performance measures were adopted for system performance:

- Percent of reliable person-miles traveled on the Interstate; and
- Percent of reliable person-miles traveled on the non-Interstate NHS.

[2] Final Rule on "National Performance Management Measures; Assessing Pavement Condition for the National Highway Performance Program and Bridge Condition for the National Highway Performance Program": Docket No. FHWA–2013–0053, RIN 2125–AF53, Federal Register - Vol. 82, No. 11, Pg. 5886- January 18, 2017: https://www.gpo.gov/fdsys/pkg/FR-2017-01-18/pdf/2017-00550.pdf.

[3] Final Rule on "National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program": Docket No. FHWA–2013–0054, RIN 2125–AF54, Federal Register - Vol. 82, No. 11, Pg. 5970 - January 18, 2017: https://www.gpo.gov/fdsys/pkg/FR-2017-01-18/pdf/2017-00681.pdf.

One measure to assess freight movement on the Interstate system was adopted:

- Percentage of Interstate system mileage providing for reliable truck travel time (Truck Travel Time Reliability Index).

The final rule also established the following measures to help assess the performance of the CMAQ program:

- Total emissions reductions for applicable pollutants;
- Annual hours of peak hour excessive delay per capita; and
- Percent of non-single occupancy vehicle travel.

As discussed in section 2.2 below, the "annual hours of peak hour excessive delay per capita" and "percent of non-single occupancy vehicle travel" performance measures are not applicable to the State of Montana.

2.1.4. Transit Asset Management Final Rule

The Federal Transit Administration (FTA) adopted the *Transit Asset Management Final Rule*[4] which requires public transportation providers to develop and implement transit asset management (TAM) plans with asset inventories, condition assessments of inventoried assets, and a prioritized list of investments to improve the state of good repair of their capital assets. The final rule (effective as of October 1, 2016) also established "state of good repair" (SGR) standards and four associated performance measures including:

- The percentage of non-revenue, support-service and maintenance vehicles that have either met or exceeded their ULB;
- The percentage of rolling stock vehicles that have either met or exceeded their ULB;
- The percentage of track segments with performance restrictions for rail fixed guideway, track, signals, and systems; and
- The percentage of facilities rated below condition 3 on the TERM scale.

2.2. State of Montana Performance Measures and Targets

The recently enacted Final Rules mandate MDT measure and report performance in the following areas: safety performance, pavement and bridge, system performance/congestion, freight movement, congestion mitigation and air quality (CMAQ), and transit asset management.

Consistent with this requirement, MDT has implemented the national performance measures with the following exceptions:

- Per 23 CFR 490.703, MDT is not required to implement the *Annual Hours of Peak Hour Excessive Delay Per Capita Measure* or the *Percent of Non-SOV Travel Measure* because the state of Montana lacks urban areas with populations exceeding 1 million.
- The *Percent of the Interstate System Where Peak Hour Travel Times Meet Expectations* and *Percent of the Non-Interstate NHS Where Peak Hour Travel Times Meet Expectations* measures are not applicable to Montana.

[4] Final Rule on "Transit Asset Management; National Transit Database": Docket No. FTA–2014–0020, RIN 2132–AB07, Federal Register - Federal Register / Vol. 81, No. 143, Pg. 48890 - July 26, 2016: https://www.gpo.gov/fdsys/pkg/FR-2016-07-26/pdf/2016-16883.pdf.

- The performance measure for rail fixed guideway, track, signals, and systems is not applicable because the state lacks rail fixed guideway public transportation assets.

MDT has the option of establishing additional performance measures.

The federal rulemaking outlines a process to be used by State DOTs to establish quantifiable statewide performance targets to be achieved over 2-year and 4-year performance periods, with the first performance period beginning in 2018. The Final Rules require State DOTs to set statewide performance targets by May 20, 2018 for the condition of pavements on the Interstate System and on the NHS (excluding the Interstate); for the condition of bridges on the NHS, including bridges crossing state borders regardless of ownership or maintenance responsibility; for total emission reductions, and for federally-funded public transportation capital assets included in a statewide group transit asset management plan (TAMP). State DOTs must also incorporate performance targets into their statewide transportation plans and STIPs.

Consistent with federal rules, MDT has established all required performance targets for the national performance measures applicable in Montana. Adopted performance targets are summarized below.

SAFETY PERFORMANCE

PERFORMANCE MEASURE	2018 TARGET 5-YEAR AVERAGE*
Number of Fatalities	187.4
Fatality Rate	1.462
Number of Serious Injuries.	892.8
Serious Injury Rate	6.968
Number of combined non-motorized fatalities and non-motorized serious injuries.	73.2

* Safety performance targets are statewide totals or rates for 2019. Targets are based on a rolling 5-year average and determined annually.

PAVEMENT AND BRIDGE CONDITION

PERFORMANCE MEASURE	2-YEAR TARGET	4-YEAR TARGET
NHS Pavement Condition	—	54% = Good Condition 3% = Poor Condition
Non-Interstate NHS Pavement Condition	44% = Good Condition 6% = Poor Condition	44% = Good Condition 6% = Poor Condition
NHS Bridge Condition (Bridge Deck Area)	12% = Good Condition 9% = Poor Condition	12% = Good Condition 9% = Poor Condition

SYSTEM PERFORMANCE AND FREIGHT MOVEMENT

PERFORMANCE MEASURE	2-YEAR & 4-YEAR TARGETS
Interstate Travel Time Reliability (% Reliable – person miles)	98%
Non-Interstate Travel Time Reliability (% Reliable – person miles)	80%
Interstate Truck Travel Time Reliability (Truck Travel Time Reliability Index)	1.30

CMAQ ON-ROAD EMISSIONS SOURCES

PERFORMANCE MEASURE	2-YEAR & 4-YEAR TARGETS*
CO Emissions	> 0 kg/day
PM_{10} Emissions	
$PM_{2.5}$ Emissions	

* Targets for each criteria pollutant are based on quantitative emissions benefits reported in the CMAQ Public Access System — Missoula's mandatorily funded projects. This limits future performance to certain projects funded in the Missoula MPO area.

After targets are established, FHWA will regularly assess progress in achieving defined performance targets. Significant progress will be demonstrated if condition is equal to or better than the established target, or better than the baseline condition. If significant progress toward achieving the performance target cannot be demonstrated in two consecutive FHWA assessments, State DOTs are required to include a description of actions to be undertaken to achieve all related targets in its next performance report. For transit assets included in the statewide group TAMP, State DOTs must submit a consolidated report each year to the FTA describing progress made towards meeting performance targets. Failure to report may result in ineligibility for federal funding.

MDT is obligated to submit a baseline Performance Report by October 1, 2018, followed by 2-year and 4-year Performance Reports in 2020 and 2022, respectively.

2.3. MPO Performance Measures and Targets

MPOs must also establish performance targets that reflect national performance goals and the performance measures adopted by USDOT. To ensure consistency, MAP-21 and the FAST Act requires coordination between State DOTs, MPOs, and transit agencies when setting performance targets.

MPOs are required to set performance targets in relation to the national performance measures within 180 days of when States set performance targets. MPOs can decide to support the relevant State target or establish their own, unique and quantifiable target each time the State DOT establishes a target. To ensure consistency, MPOs must, to the maximum extent practicable, coordinate with the relevant State DOT and public transportation providers when setting performance targets.

3.0 GREAT FALLS AREA LRTP PERFORMANCE MEASURES

Federal transportation planning requirements dictate that MPOs describe the performance measures and targets that will be used in their metropolitan area transportation planning processes. Consistent with this requirement, the Great Falls MPO has incorporated the performance measures established by MDT with respect to pavement and bridge condition, safety performance, system performance and freight movement, congestion mitigation and air quality (CMAQ), and transit asset management into the LRTP.

The performance measures discussed previously are directly related to the goals and objectives established for the LRTP. The performance measures and their alignment with the stated goals of the LRTP are presented in **Table 1**.

Table 1: MPO Adopted Performance Measures to Support LRTP Goals

			Great Falls Area LRTP Goals						
			Goal 1: Maintain the existing transportation system.	**Goal 2**: Improve the efficiency, performance and connectivity of a balanced transportation system.	**Goal 3**: Promote consistency between land use and transportation plans to enhance mobility and accessibility.	**Goal 4**: Provide a safe and secure transportation system.	**Goal 5**: Support economic vitality of the community.	**Goal 6**: Protect and enhance environmental sustainability, provide opportunities for active lifestyles, and conserve natural and cultural resources.	**Goal 7**: Maximize the cost effectiveness of transportation.
PERFORMANCE MEASURES	PAVEMENT AND BRIDGE CONDITION	Percentage of pavements on the Interstate System in Good condition.	✓						✓
		Percentage of pavements on the Interstate System in Poor condition.	✓						✓
		Percentage of pavements on the NHS (excluding the Interstate System) in Good condition.	✓						✓
		Percentage of pavements on the NHS (excluding the Interstate System) in Poor condition.	✓						✓
		Percentage of NHS bridges classified as in Good condition.	✓						✓
		Percentage of NHS bridges classified as in Poor condition.	✓						✓
	SAFETY PERFORMANCE	Number of fatalities				✓			
		Rate of fatalities per vehicle miles traveled (VMT).				✓			
		Number of serious injuries.				✓			
		Rate of serious injuries per VMT.				✓			
		Number of combined non-motorized fatalities and non-motorized serious injuries.				✓			
	SYSTEM PERFORMANCE/ FREIGHTMOVEMENT/ CONGESTION/CMAQ	Percent of reliable person-miles traveled on the Interstate.	✓	✓			✓		
		Percent of reliable person-miles traveled on the non-Interstate NHS.	✓	✓			✓		
		Percentage of Interstate system mileage providing for reliable truck travel time (Truck Travel Time Reliability Index).	✓	✓			✓		
		Total emissions reductions for applicable pollutants.			✓			✓	
	TRANSIT ASSET MANAGEMENT	The percentage of non-revenue, support-service and maintenance vehicles that have either met or exceeded their useful life benchmark (ULB).	✓	✓					
		The percentage of rolling stock vehicles that have either met or exceeded their ULB.	✓	✓					
		The percentage of facilities rated below condition 3 on the Transit Economic Requirements Model (TERM) scale.	✓	✓					

4.0 GREAT FALLS AREA LRTP PERFORMANCE TARGETS

MPOs must set targets, consistent with the Performance Measures in 23 U.S.C.150 and target setting framework in 23 U.S.C. 490 within 180 days of the date when the State DOT/Transit Agency sets their targets. MPOs have the option to either: 1) set their own targets for each performance measure; or 2) adopt the state targets and agree to plan and program projects so that they contribute to the accomplishment of the relevant state target.

The Great Falls MPO has elected to adopt the state-established performance targets for safety performance, pavement and bridge condition, system performance and freight movement, and CMAQ on-road emissions sources presented in **Table 2**. The MPO will modify the LRTP to include other performance targets for the metropolitan area as they are subsequently established and adopted by MDT.

Table 2: Great Falls LRTP Performance Targets

	PERFORMANCE MEASURE	PERFORMANCE TARGET
PAVEMENT AND BRIDGE CONDITION	Percentage of pavements on the Interstate System in Good condition.	54% (4-year Target)
	Percentage of pavements on the Interstate System in Poor condition.	3% (4-year Target)
	Percentage of pavements on the NHS (excluding the Interstate System) in Good condition.	44% (2-& 4-year Targets)
	Percentage of pavements on the NHS (excluding the Interstate System) in Poor condition.	6% (2-& 4-year Targets)
	Percentage of NHS bridges classified as in Good condition.	12% (2-& 4-year Target)
	Percentage of NHS bridges classified as in Poor condition.	9% (2-& 4-year Target)
SAFETY PERFORMANCE	Number of Fatalities	187.4*
	Fatality Rate	1.462*
	Number of Serious Injuries	892.8*
	Serious Injury Rate	6.968*
	Number of combined non-motorized fatalities and non-motorized serious injuries	73.2*
SYSTEM PERFORMANCE/ FREIGHTMOVEMENT/CMAC ON-ROAD EMISSIONS SOURCES	Interstate Travel Time Reliability (% Reliable – person miles)	98% (2-& 4-year Targets)
	Non-Interstate Travel Time Reliability (% Reliable – person miles)	80% (2-& 4-year Targets)
	Interstate Truck Travel Time Reliability (Truck Travel Time Reliability Index)	1.30 (2-& 4-year Targets)
	CO Emissions	> 0 kg/day (2-& 4-year Targets)
	PM_{10} Emissions	
	$PM_{2.5}$ Emissions	

* Safety performance targets are statewide totals or rates for 2019. Targets are based on a rolling 5-year average and determined annually.

The Great Falls Transit District has not yet set performance targets for its transit system assets within the metropolitan area. The FAST Act requires MPO Transit Agencies to have TAMPs with transit performance targets in place by October 1, 2018. The Great Falls MPO will have 180 days from the time the Transit District sets their targets to adopt transit asset management performance targets.

4.1. Reporting Progress Towards Achieving Performance Targets

The Great Falls MPO will incorporate adopted performance targets into the TIP and discuss how the targets will be advanced and linked to investment priorities. The Great Falls MPO will coordinate with MDT to obtain routinely collected data from the agency about the condition of roadway pavement and bridges, safety performance, and the overall operation of the transportation system within the Great Falls metropolitan area. The information will help the MPO identify and advance projects in the TIP which support adopted performance targets at the statewide and local level.

The MPO will develop system performance reports at required reporting intervals to help assess progress made towards meeting specified system performance targets within the metropolitan area.

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- System Performance/Freight/CMAQ Performance Measures Final Rule, available at: https://www.federalregister.gov/d/2017-00681
- HSIP and Safety Performance Management Measures Final Rules, available at: https://www.federalregister.gov/d/2016-05190 and https://www.federalregister.gov/d/2016-05202
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APPENDIX J:
Conformity Determination



CONFORMITY DETERMINATION

February 23, 2018

GREAT FALLS AREA

Long Range Transportation Plan - 2018 Update









Prepared By:
Robert Peccia & Associates
Helena, Montana
www.rpa-hln.com

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CONFORMITY DETERMINATION

1.0 INTRODUCTION

On November 15, 1990, the Clean Air Act Amendments (CAAA) of 1990 were signed into law. The CAAA is a detailed and complex law that has had a major impact on the programs of the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). The Act requires substantial vehicle emissions reductions from the transportation sector.

The purpose of the conformity provision of the CAAA is to ensure consistency between the Federal transportation planning process and Federal air quality planning process. The regulations require that for an urban area designated as nonattainment of National Ambient Air Quality Standards (NAAQS) for transportation-related criteria pollutants, or which has a maintenance plan for such pollutants, a conformity determination must be conducted to demonstrate that its long-range transportation plan (LRTP), transportation improvement plan (TIP), or any revisions to either will not adversely affect air quality[1]. Transportation-related criteria pollutants for areas designated as nonattainment, or which have a maintenance plan, may include the following[2]:

1. Criteria pollutants including ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}); and particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$).
2. Precursor pollutants including:
    i. Volatile organic compounds (VOCs) and nitrogen oxides (NO_X) in ozone areas;
    ii. NO_X in NO_2 areas;
    iii. VOCs and/or NO_X in PM_{10} areas if the EPA Regional Administrator or the director of the State air agency has made a finding that transportation-related emissions of one or both of these precursors within the nonattainment area are a significant contributor to the PM_{10} nonattainment problem and has so notified the MPO and DOT, or if the applicable implementation plan (or implementation plan submission) establishes an approved (or adequate) budget for such emissions as part of the reasonable further progress, attainment or maintenance strategy;
    iv. NO_X in $PM_{2.5}$ areas, unless both the EPA Regional Administrator and the director of the state air agency have made a finding that transportation-related emissions of NO_X within the nonattainment area are not a significant contributor to the $PM_{2.5}$ nonattainment problem and has so notified the MPO and DOT, or the applicable implementation plan (or implementation plan submission) does not establish an approved (or adequate) budget for such emissions as part of the reasonable further progress, attainment or maintenance strategy; and
    v. VOCs, sulfur dioxide (SO_2) and/or ammonia (NH_3) in $PM_{2.5}$ areas either if the EPA Regional Administrator or the director of the state air agency has made a finding that transportation-related emissions of any of these precursors within the nonattainment area are a significant contributor to the $PM_{2.5}$ nonattainment problem and has so notified the

[1] 40 CFR 93.102(a)
[2] 40 CFR 93.102(b)

MPO and DOT, or if the applicable implementation plan (or implementation plan submission) establishes an approved (or adequate) budget for such emissions as part of the reasonable further progress, attainment or maintenance strategy.

A Conformity Determination was previously made for the *Great Falls Area Long Range Transportation Plan – 2014* based on the *Air Quality Conformity Determination Technical Memorandum* prepared by Cambridge Systematics, Inc. on November 27, 2013. Information from the Technical Memorandum and **Chapter 12** of the 2014 LRTP was reviewed and subsequent changes in the status of the Great Falls CO Maintenance Area, CO monitoring strategies, and administrative actions relevant to the Maintenance Area were identified to produce this updated *Conformity Determination* memorandum.

2.0 ADMINISTRATIVE BACKGROUND

On September 9, 1980, the United States Environmental Protection Agency (EPA) designated Great Falls as non-attainment for carbon monoxide (CO). The designation followed sixteen violations of the NAAQS 8-hour CO standard at an air quality monitor on 10th Avenue South. The NAAQS for CO is 9.0 parts per million (ppm) for an 8-hour average concentration, not to be exceeded more than once per calendar year. Consensus between EPA and local officials established the 10th Avenue South corridor as the nonattainment boundary in lieu of the city limits. Following the non-attainment designation, control plans were developed, but none were approved by EPA. The 1977 emissions inventory listed motor vehicle emissions, wood smoke, and industrial processes as the primary contributors to the CO violations. The March 9, 1984 control plan demonstrated attainment based on projected automobile emissions reductions and a significant reduction in CO from the former Phillips Refinery, now Calumet Montana Refining. That control plan was withdrawn due to the failure of the refining company to modify its catalytic cracking unit. A second control plan was submitted to EPA on March 28, 1986. On January 26, 1987, EPA proposed to approve the Great Falls CO control plan. However, Great Falls missed the December 31, 1987 attainment deadline, (meaning Great Falls had a violation of the standard in 1987), and the *Montana CO State Implementation Plan* (SIP) was ruled inadequate, resulting in a “SIP call” for the Great Falls CO nonattainment area on May 26, 1988.

On September 7, 1990, EPA published two actions regarding the Great Falls element of the SIP. EPA published a proposed rule that would disapprove the attainment demonstration contained in the March 28, 1986 SIP revision. However, EPA never took final action on that proposed rule. EPA also published a final rule on September 7, 1990 that approved the CO control measures from the March 28, 1986 SIP revision for their strengthening effect on the SIP. Great Falls was reevaluated in September 1990, based on the 1990 CAAA and the lack of exceedances in the CO monitoring data for 1988 and 1989. On November 6, 1991, EPA designated Great Falls as a “not classified” CO non-attainment area. However, redesignation to attainment required a new emission inventory and the development of a maintenance plan, which the Montana Department of Environmental Quality (DEQ) subsequently developed.

In 1998, DEQ submitted a 1996 Inventory Preparation Plan to Federal, State and local agencies for review and comment. Subsequently, DEQ submitted the 1996 base year emission inventory to EPA in February 2000, along with a ten-year maintenance plan and a request to redesignate Great Falls as an attainment area. On July 8, 2002, EPA redesignated Great Falls as a “limited maintenance plan” attainment area.

With the redesignation to attainment, Great Falls was required to comply with the provisions of the December 19, 2000 *Carbon Monoxide Limited Maintenance Plan* (December 2000 LMP) and submit a CAA section 175A(b) required revised maintenance plan in 2010 that provided for maintenance of the CO

standards for an additional ten years. Provided Great Falls does not have any further CO NAAQS violations during the maintenance period, it can request full attainment status.

The Montana DEQ submitted an updated *Great Falls Carbon Monoxide Limited Maintenance Plan* (2011 LMP Submittal) on July 13, 2011, as required by 42 USC 7505(a). The 2011 LMP Submittal documents the first ten years of CO monitoring under the December 2000 LMP, and details strategies for maintaining CO standards for the subsequent ten years. As such, the 2011 LMP Submittal document fulfilled the criteria established in 40 CFR Part 51, Appendix V.

On June 22, 2012, the Montana DEQ submitted SIP revisions that included an alternative CO monitoring strategy documented in the 2011 LMP Submittal. Ambient CO levels have decreased significantly due to federal tailpipe standards and turnover of the vehicle fleet in the United States. Therefore, the DEQ determined that the using the resource-intensive CO analyzers to confirm CO levels was not justifiable. The alternative CO monitoring method includes an annual review of traffic volumes using data from MDT permanent automatic traffic recorders (ATR) in Great Falls. Thresholds are defined based on the percent increase in consecutive, rolling 3-year ADT volumes and correlated to presumed changes in ambient CO concentrations. The DEQ worked closely with EPA Region 8 staff to develop the alternative CO monitoring methodology to ensure that CO LMP areas maintain compliance with national standards. The procedures are presented in the document entitled *State of Montana Alternative CO Monitoring Strategy.*

On May 1, 2015, EPA approved the revised Great Falls Maintenance Plan submitted on July 13, 2011. The maintenance plan meets the applicable CAA requirements and EPA determined it is sufficient to provide for maintenance of the NAAQS for CO over the course of the second 10-year maintenance period out to 2022. The May 1, 2015 action by EPA also approved the State's alternative CO monitoring strategy for the Great Falls CO maintenance area submitted on June 22, 2012. With this approval, the revised Great Falls CO Maintenance Plan (the 2011 LMP submittal) is the controlling document for this air quality conformity determination.

The following conformity determination was made in accordance with the above referenced Federal regulations. The determination is for CO and applies to the *Great Falls Area Long Range Transportation Plan - 2018 Update* and the *Carbon Monoxide State Implementation Plan* for the State of Montana. As of the date of this conformity determination, the Great Falls urban area is not designated as a nonattainment or maintenance area for any other air pollutant.

3.0 CONFORMITY DETERMINATION

3.1. Interagency Consultation

This conformity determination follows the general consultation guidance contained in the State of Montana Air Quality Rules on Conformity (ARM Chapter 17.8 Subchapter 13 Conformity). These rules incorporate by reference Federal regulations contained in 40 CFR Part 93, Subpart A. This consultation generally involved a cooperative and coordinated process including the Montana Department of Transportation (MDT), the Montana DEQ and the Great Falls City-County Planning Board.

The Montana DEQ and MDT coordinate regarding air quality and transportation conformity on behalf of metropolitan planning organizations (MPO) such as the Great Falls City-County Planning Board. Coordination is conducted in accordance with applicable Federal code (40 CFR 93) and state administrative rules (ARM Title 17, Chapter 8, Subchapter 13). Coordination typically takes the form of consultation through letter correspondence between the state agencies.

Air quality planning is an integral part of the Great Falls transportation planning process. As such, air quality has received specific attention during development of the numerous plans, programs and projects of the process. Unified Planning Work Programs have included specific annual work activities dealing with addressing the initial CO problem on 10th Avenue South and the preparation of revisions to the SIP. Any additional activities required to address past CO problems on 10th Avenue South will be completed under *Work Element 100: Transportation Program Administration & Participation*[3]. Additionally, *Work Element 302: Transportation Plans, Analyses, Assessments & Consistency Determinations* presents procedures to assure consistency/conformity between air quality and transportation planning plans and programs, as well as other environmental issues such as noise, water quality, air, and aesthetics.

3.2. Public Involvement

The Great Falls MPO conducts an ongoing public and stakeholder engagement process for all transportation planning activities, including development and approval of the transportation plan, TIP, and conformity determination. This process is conducted in accordance with the *Great Falls Planning Public Participation Plan*, which was last updated in December 2011. The *Public Participation Plan* is subject to periodic FHWA and FTA review and concurrence for consistency with Federal planning regulations. Such concurrence was most recently provided through TIP approval on September 1, 2017 by the TAC and PCC and September 12, 2017 by MDT. The *Great Falls Area LRTP – 2018 Update* provides a discussion on the outreach process conducted during plan development.

3.3. Latest Planning Assumptions and Emissions Model

The October 6, 1995 EPA policy memorandum for limited maintenance plans in non-classifiable CO nonattainment areas included a discussion of the applicability of the conformity rule requirements in these areas. The following section addresses the applicable requirements. According to this policy, a limited maintenance plan attainment area is not required to project emissions over the maintenance period because the air quality design value for the area is low enough that the stationary source permitting program, existing SIP controls, and Federal control measures provide adequate assurance of maintenance of the CO standard over the initial 10-year maintenance period.

In the October 6, 1995 policy memorandum, the EPA states: “The maintenance demonstration requirement is considered to be satisfied for nonclassifiable areas if the monitoring data show that the area is meeting the air quality criteria for limited maintenance areas (7.65 ppm or 85% of the CO NAAQS).” According to EPA’s July 8, 2002 Direct Final Rule, the CO design value for the Great Falls area was 4.5 ppm, which was below the limited maintenance requirement of 7.65 ppm. More recent data show lower levels of CO. The 2011 LMP Submittal states: “The current CO monitoring site in Great Falls, Overlook Park (#30-013-0001), has operated in the city park at the corner of 10th Avenue South and 2nd Street since mid-2001. Based on the data from 2008 and 2009, the latest design value is 1.6 ppm, which is well below the 8-hour NAAQS of 9 ppm and the CO LMP eligibility threshold of 7.65 ppm.”

EPA considers the maintenance demonstration requirement to be satisfied for areas that qualify for and use the LMP option. Based on its evaluation of the 2011 LMP Submittal and its subsequent approval in May 1, 2015, EPA concluded that because CO design values in the Great Falls area are consistently well below the LMP threshold, the State has adequately demonstrated the Great Falls area will maintain the

[3] Great Falls Unified Planning Work Program Federal Fiscal Year 2018, https://greatfallsmt.net/sites/default/files/fileattachments/planning_and_community_development/page/41061/upwp_ffy_2018_final.pdf, accessed January 2018.

NAAQS for CO into the future. By approving the alternative CO monitoring strategy for the Great Falls CO maintenance area, EPA recognizes the strategy is adequate to verify continued attainment of the NAAQS for CO in Great Falls.

Given this information, the Great Falls area adequately demonstrates maintenance.

3.4. Regional Emissions Analysis

As previously noted, the alternative CO monitoring method includes an annual review of traffic volumes using data from MDT permanent ATRs in Great Falls by the Montana DEQ to demonstrate ongoing compliance with the NAAQS for CO. Thresholds are defined based on the percent increase in consecutive, rolling 3-year ADT volumes and correlated to presumed changes in ambient CO concentrations.

40 CFR 93.109(e) indicates an area is not required to satisfy the regional emissions analysis for Sections 93.118 or 93.119 for a given pollutant and NAAQS, if the area has an adequate or approved LMP for such pollutant and NAAQS. The LMP must demonstrate that it would be unreasonable to expect that such an area would experience enough motor vehicle emissions growth for a NAAQS violation to occur. Consistent with the EPA's October 6, 1995 policy memorandum for LMPs and 40 CFR 93.109(e), the EPA's May 1, 2015 approval of the revised Great Falls Maintenance Plan affirms that no regional emissions analyses for future transportation CO conformity determinations are required for the CO LMP period.

For these reasons, no regional emissions analysis under Sections 93.118 or 93.119 of the conformity rule is required for plan conformity.

3.5. Timely Implementation of SIP Transportation Control Measures

Transportation Control Measures (TCM) are actions that are sometime included in a SIP to help reduce on-road mobile source emissions. TCMs are designed to reduce emissions from motor vehicles by reducing vehicle use, changing traffic flow, or changing congestion conditions. The currently-approved SIP for the Great Falls CO LMP area does not include any TCMs. Therefore, the TCM timely implementation requirement is not applicable to this conformity determination.

3.6. Fiscal Constraint

Metropolitan transportation plans are required to meet Federal fiscal constraint requirements as detailed in 23 CFR 450.322(b) (11). For nonattainment and maintenance areas such as Great Falls, this fiscal constraint requirement must be met before a conformity determination is approved. The *Great Falls Area LRTP – 2018 Update* documents that planned expenditures are consistent with existing and proposed funding sources that can reasonably be expected to be available for transportation uses. As such, the transportation plan meets the fiscal constraint requirement.

4.0 CONCLUSION

It is the conclusion of this determination that in addition to the satisfaction of the aforementioned conditions and requirements, the G*reat Falls Area Long Range Transportation Plan – 2018 Update* is found to be in conformance with the applicable provisions of section 176(c) of the Clean Air Act, 40 CFR 93 Subpart A, and the revised Great Falls CO Maintenance Plan element of the SIP for the State of Montana.