Montana Department of Transportation

PO Box 201001
Helena, MT 59620-1001

VISION ZERO
zero deaths
zero serious injuries

Memorandum

To: e-distribution
see listing below

From: Lesly Tribelhorn, P.E. LT
Highways Engineer

Date: September 28, 2018

Subject: Placing Topsoil on the Surfacing Inslope

This design memo serves as clarification to the November 20, 1996 design memo as approved by Gary A. Gilmore, Highways & Engineering Division Administrator (attached).

Topsoil will be placed on the gravel surfacing inslope to within 20 inches of the edge of plant mix for all projects that involve reconstruction or widening of the base course gravels. Exceptions are permissible as prescribed below.

- Placing topsoil on the gravel inslope is not viable for all projects. Topsoil does not need to be placed in areas where the adjacent terrain precludes the establishment of vegetation or that require a high degree of shoulder maintenance. This may include areas that are heavily sanded or have rock faces.
- The placement of topsoil on the gravel inslope should be evaluated at the preliminary field review with a final decision being made after the alignment and grade are determined.
- Only the available topsoil obtained from normal salvage operations would be used. MDT will not import topsoil from off-site sources specifically for surfacing inslope coverage. Normal construction practices will be used to place the topsoil on the gravel inslope.

Clarification points:

- Convene a multi-disciplinary team to address all concerns regarding topsoil on the surfacing gravel as early in the design process as possible. This team should include representatives from Environmental Services, Geotechnical, Maintenance (field and headquarters), Design, and others as necessary.
- Consider such factors as moisture content in the subgrade, types of vegetation anticipated, aesthetics, potential for contamination of base material with fines, potential for adding sub-surface drainage features or improving the draining capacity of the subgrade material, and freeze-thaw cycles.

- Remember that MDT is required by law to "seed barrow pits, slopes, and shoulders to an adaptable perennial grass or combination of perennial grasses and legumes whenever establishment of perennial grass covers seem suitable." (MCA 60-2-208). MDT is expected to maintain a noxious weed-free roadway environment.
- The Montana County Weed Act (2010) and 2014 Executive Order Establishing the Montana Invasive Species Advisory Council provide direction for controlling noxious weeds, including the reestablishment of "a cover of beneficial plants."
- The gravel surfacing inslope is a constructed feature utilizing processed materials rather than a disturbed area and MDT is not required to topsoil the driving surface of a gravel road. However, the inslope does behave like a disturbed area concerning weed propagation and MDT is required to control noxious weeds. Therefore, MDT is taking steps to minimize the spread of weeds. Hence the need for topsoil placement, seeding etc.
- Benefits to topsoil and seeding include:
    - Topsoil provides the foundation necessary to establish a desired vegetative cover and allow the designed species to effectively compete with the noxious weeds.
    - The establishment of desirable vegetation will reduce the volume of herbicides applied or result in herbicide applications having a greater effect on weed reduction.
    - Environmental impacts and maintenance costs will be reduced over time and will mitigate public scrutiny of herbicide use by MDT forces.
    - Established desirable vegetation improves the appearance of the roadside and has generated positive feedback from the traveling public.
- Placing topsoil on the gravel inslope may not be practical in all situations. Impractical project sites include those with little or no established vegetation, minimal topsoil, and adjacent rock slopes.
- There may be specific project locations where placing topsoil on the surfacing inslope could be wasteful or detrimental, and all disciplines agree to forgo the treatment.
- Document all exceptions in the Scope of Work Report Maintenance Items section (what will be done and why the decision was made). Provide solid justification. One person's preference may not be in the best interest of MDT.

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Montana Department of Transportation
Helena, Montana 59620-1001

Memorandum

To: Gary A. Gilmore, P.E., Administrator
Highways & Engineering Division

From: Carl S. Peil, P.E.
Preconstruction Engineer

Carl S. Peil

Date: November 18, 1996

Subject: Placing Topsoil on the Surfacing Inslope

A Value Engineering team was established to conduct a study of the effects of placing topsoil on the surfacing inslope to promote the establishment of beneficial vegetation. The study assessed the applicability of the County Noxious Weed Control Act to surfacing inslopes. It also evaluated the effects of the placement of topsoil on pavement structure, drainage, maintenance and safety.

The conclusions of the Value Engineering team were reviewed by representatives of the Preconstruction Bureau, the Construction Bureau, the Maintenance Division and the FHWA. The representatives concurred with the conclusions of the VE team and as a result of the study we have determined that the placement of topsoil on the gravel inslope provides an overall long-term benefit. Consequently, we request that you approve the following modifications to our standard design and construction practices:

1. Topsoil will be placed on the gravel surfacing inslope to within 0.5 m of the edge of plant mix for all projects that involve reconstruction or widening of the base course gravels, subject to the following limitations.

2. Placing topsoil on the gravel inslope is not viable for all projects. Topsoil does not need to be placed in areas where the adjacent terrain precludes the establishment of vegetation or that require a high degree of shoulder maintenance. Areas that are heavily sanded or have rock faces, such as mountain passes, typically do not support vegetation. The placement of topsoil on the gravel inslope should be evaluated at the preliminary field review with a final decision being made after the alignment and grade are determined.

282

3. Only the available topsoil obtained from normal topsoil salvage operations will be used. We will <u>not</u> import topsoil from off-site sources. Normal construction practices will be utilized to place the topsoil on the gravel inslope, as it would on a any affected surface

4. The placement of topsoil on the gravel inslope will be done for all active projects that have not yet been submitted to the checker.

Although this will be our new standard practice, if problems arise we will evaluate them to determine if the practice should be continued.

If anyone on the distribution has questions or would like a copy of the study, please contact us.

Approved Gary A Gilmore Date Nov 20, 1996
Gary A. Gilmore, P.E., Administrator
Highways & Engineering Division

CSP.pf

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PLACEMENT OF TOPSOIL AND SEEDING
THE GRAVEL SURFACING INSLOPE

Value Engineering Study

A Value Engineering Team was established to determine the benefits and detriments of placing topsoil on the gravel surfacing inslope to promote the growth of vegetation up to the edge of the paved surface.

The Department considered it necessary to evaluate the MDT's current construction practice of not providing any vegetation treatment on the gravel inslope, when the question was raised whether this practice violates the County Noxious Weed Control Act. This Act states:

> "whenever any person or agency disturbs vegetation on an easement or right-of-way within a district by construction of a road, irrigation or drainage ditch, pipeline, transmission line or other development, the board shall require that the disturbed areas be seeded, planted, or otherwise managed to reestablish a cover of beneficial plants."

The Montana legislature enacted the Montana highway Seeding Law in 1961. It exists in current form as Montana Code Annotated 60-2-208. This act mandates the following:

> "Seeding along highways. (1) After a federal-aid or state highway is constructed, the department shall seed borrow pits, slopes and shoulders to an adaptable perennial grass, or combination of perennial grasses and legumes whenever establishment of perennial grass covers seems suitable."

In April 1994, the President issued a memorandum to all Federal agencies on the subject of landscaping of federally-funded projects. Guidance contained in the Presidential Executive Memorandum was published in the August 10, 1995 Federal Register. The memorandum focused on 5 guiding principles, of which two relate directly to roadside environments:

> 1)"Design, use or promote construction practices that minimize adverse effects on the natural habitat, and 2) Seek to prevent pollution by, among other things, reducing fertilizer and pesticide use, using integrated pest management techniques..."

Within CFR 752.2-Landscape and Roadside development, it is stated as policy that:

> (a) Highway aesthetics is a most important

consideration in the Federal-aid highway program. Highways must not only blend with our natural, social and cultural environment, but also provide pleasure and satisfaction in their use. Further, under 752.4-Landscape Development; (d) In rural areas, new and major reconstructed highways should be landscaped as appropriate for the adjacent environment. Planning should include the opportunity for natural regeneration of native growth and the management of that growth.

While no specific references are made regarding acceptable and non-acceptable practices, we can presume an intent to encourage the construction and management of roadsides in a manner that seeks to meet the objectives contained in the various forms of legislation and guidance referred to above.

The Value Engineering Team's study evaluated the following concepts:

1. The benefits of establishing a designed plant community on the gravel inslope.

2. The theoretical and actual function of the gravel inslope under current practice.

3. The effect placing topsoil on the inslope will have on this function.

4. The effect establishing vegetation will have on maintenance practices and how maintenance practices will affect the establishment of vegetation.

<u>Topsoil & Vegetation - Benefits</u>

The preferred form of vegetation to be established on the surfacing inslopes are rhizomatous grasses. These are perennial grasses that reproduce by seed and root structures (rhizomes). Common examples of rhizomatous grasses include Kentucky bluegrass, quackgrass, and western, streambank, and thickspike wheatgrasses. The latter three are native species that would be seeded almost exclusively in a 15 foot wide strip adjacent to the edge of pavement. They provide numerous advantages to species that possess a bunchgrass type growthform. Notably; short growing stature, tolerance to drought and nutrient stress and mechanical damage. They also tend to form dense stands that suppress invasion of other plants. One or more of the various species of these grasses will grow in the various soil and climatic conditions throughout Montana.

We have determined that the placement of topsoil on the gravel inslope is necessary to establish a desired vegetative cover. Seeding the gravel inslope without placing topsoil will not allow the designed species to

through a planned revegetation program, and would offer greater concealment of wildlife next to the travel way.

Gravel Inslopes - Function & Performance

The issue of whether the MDT's current practice is in violation of the County Noxious Weed Control Act depends on the required function of the gravel inslope. If it can be demonstrated that an exposed gravel inslope is necessary to the structural or safety function of a roadway, the exposed inslope should not be considered a disturbed area and then not subject to the provisions of the County Noxious Weed Control Act.

Structure

A major concern with placing topsoil on the gravel inslope is that the topsoil would tend to create an impervious layer which would impede subsurface drainage through the base gravel. The new gradation for our Crushed Base Course (CBC) allows up to 8% material passing the 200 sieve. The MDT has conducted limited research which indicates that the transmissivity of this material is far below the 1000 feet/day that current design criteria recommends for permeable bases. Several unquantified demonstrations have also corroborated the lack of permeability of our present CBC. Consequently, subsurface drainage through our base gravels is minimal and placing topsoil on the inslope will have a negligible effect on the movement of moisture through the subgrade.

With time, the exposed gravel inslope becomes more or less sealed with fines due to sanding operations and material deposition due to wind and water. Assuming our base gravel was free-draining, moisture would still be trapped at the exposed interface due to natural deposition of fines. In addition, a well vegetated surface will remove considerably more moisture through evapotranspiration than an equal area without vegetation. Therefore, moisture that could reach the gravel inslope would be removed from the base more quickly through a vegetated inslope rather than the exposed gravel inslope.

If a truly free-draining base is constructed, it should be used in conjunction with a separation fabric and piped outlets. The placing of topsoil would not affect the function of these constructed outfalls.

A study(1) was conducted to determine if vegetation is a major factor in premature pavement deterioration. The study could find no apparent relationship between pavement condition and vegetation of the road shoulder. However, the study noted that so many factors affect pavement condition that it was difficult to single out the influence of a single factor. Therefore, we determined that this information is inconclusive.

effectively compete with the noxious weeds.

The intent of topsoil placement in our interpretation is that "topsoil" is material available on or adjacent to the project. It should be salvaged and placed in accordance with the Standard Specifications with the exception that the gravel inslope would not be scarified or ripped.

Highway corridors play a significant role in the migration of noxious weeds. The establishment of desirable grasses would reduce the potential for noxious weed growth.

The establishment of desirable vegetation will reduce the volume of herbicides applied or result in the application of the same volume having a greater effect on weed reduction.

Although we cannot provide a quantitative correlation between reduced herbicide usage and cost savings, we believe reduced usage will provide long-term economic benefits. The use of various herbicides and the environmental effects of their use may come under scrutiny and more limitations in the future. Stricter regulations as well as inflation will increase the unit cost of herbicides with time.

The establishment of a desirable vegetation will provide a public relations benefit by reducing roadside propagation of noxious weeds and a general improvement in the appearance of the highway corridor. More importantly, it will reduce the incidence of weed invasion off MDT R/W onto adjacent farm and rangeland.

We evaluated the effect that vegetation on the inslope would have on water quality. The evidence indicates that compacted gravel on a 6:1 slope is not susceptible to erosion. Where erosion is in evidence on the gravel inslope, it is the result of steeper inslopes that are in place on older roadways, or as a continuation of erosion beginning on the fill slopes. The control of sedimentation in waterways is a result of the grade and vegetative cover of the constructed slopes and roadside ditches. Consequently, the establishment of vegetation on the inslope will have a minimal but positive effect on erosion and water quality.

We discussed the effect a vegetated inslope would have on wildlife related accidents. We determined that these accidents are much more closely related to wildlife densities, feeding habits and movement corridors. The highest number of wildlife related accidents occur in the spring and fall. This may be due in part to the availability of vegetation on the roadside at these times. We also noted that the weedy-type vegetation that does eventually grow on the gravel inslope is taller and more sought after than the grasses that would be established

Safety

We reviewed the effect topsoil would have on the safety of vehicle leaving the roadway. We also conducted a literature search for other information in this area. None of the research we reviewed specifically discussed the effect vegetation would have on vehicles leaving the roadway. One paper(2) reviewed the tripping mechanisms which caused the overturning of vehicles, and concluded that "tire-soil forces" were the dominant cause of vehicle rollover in 80.6% of rural off-road accidents. The report states:

> "Mechanisms contributing to tire-soil forces include: rate of slope, slope change, soil cover and tire plowing in soft soil. Police level accident files such as the Illinois data used in this study do not provide the level of detail required to sort out the relative importance and interaction of these variables as tripping mechanisms."

The report also indicated that roadside rollovers increase with speed.

We believe that placing topsoil on the gravel inslope could be related to soil cover and tire plowing in soft soil. However, the report did not define what depth of soil cover or soft soil would establish a tripping mechanism. We did not find any research that related soil cover to the tripping mechanism in vehicles.

A second study(3) indicated that the number and severity of accidents was increased where a roadway discontinuity exists on the shoulder. The discontinuity occurred when the shoulder or inslope had a lower coefficient of friction than the pavement. This condition was most severe under wet conditions. The report indicated that providing wider shoulders having the same surfacing as the travel lanes reduces number and severity of accidents. Although the report did not discuss the effect of a discontinuity on the inslopes, we may infer that the discontinuity between a paved surface and a vegetated inslope is greater than the discontinuity between the paved surface and a compacted gravel inslope.

In summary, the results of research into the safety aspects of vegetating the surfacing inslope are inconclusive.

Survey of Other States

We contacted other state DOTs concerning their present treatments of surfacing inslopes. The majority of eastern, southern and midwestern states vegetate the inslopes. Vegetating the inslopes occurs less frequently among the non-coastal western states. None of the states that do vegetate the inslopes noted any structural or safety problems related to the vegetation. However, none of the

states that responded conducted specific evaluations or comparative studies of the inslopes.

The states that practice the placement of topsoil on the surfacing inslope utilize a variety of surfacing designs from concrete to bituminous riding surfaces, gravel, asphalt stabilized, and cement-treated bases with and without edge drains. The use of the various surfacing treatments did not appear to be related to climate or geographic location.

The South Dakota Transportation Department is practicing the vegetation of the surfacing inslopes. They have surmised that "vegetation can substantially reduce speed should a car leave the road. In the event of a vehicle rollover, the vegetation may also provide a protective cushion." They did not present any evidence to support either supposition.

The Washington DOT conducted a evaluation of their roadside vegetation management program in 1993 similar to the one summarized in this report. Their recognition of long-range cost benefits of encouraging a well-vegetated inslope were summarized as follows:

"Once a stable vegetation is established, weed production should be greatly reduced and in many instances eliminated. If proper grasses were planted that had a short mature height, very little, if any mowing would be required. Vegetation management activities immediately adjacent to the pavement would in turn drastically be reduced, and cost savings could be diverted to other needed activities. This is simply good stewardship of the public resources. Doing the right thing right. Being cost effective."

Maintenance Functions

Four primary maintenance activities will affect or be affected by the establishment of vegetation on the gravel inslope.

1. Early season snow plowing can extend as far as 8 feet beyond the paved surface to provide storage for snow removal later in the season. We were concerned that the plowing may damage vegetation. The rhizomatous grasses that would be established have extensive root systems which enable the plants to readily recover from mechanical damage. In addition, snow plowing typically occurs after the grasses have become dormant and damage to the aerial portion of the plant is superficial. We have determined that snow plowing will not seriously affect the establishment of beneficial vegetation.

2. Maintenance indicated that in certain areas they blade material back from the edge of the pavement to remove sanding material and debris. These operations were usually limited to areas that were heavily sanded in

the winter or experienced material falling on the road in cut sections. The latter areas generally are associated with steep backslopes of highly erodible material, areas with limited ditch widths or rock walls. We determined that the areas that require the heaviest sanding applications often have the same features that result in material from the backslope falling onto the road. The establishment of vegetation in these areas may not be practical because of the frequency of maintenance work and the type material that occurs in these areas.

Vegetation on the gravel inslope may trap debris and act as a barrier to roadway runoff. The concentration of runoff at a point may increase the potential for erosion. This situation presently occurs due to the vegetation which eventually is established on the inslope. The effect of intentionally establishing vegetation should not increase the incidence of occurrence nor should it result in a greater concentration of runoff.

3. We were concerned that a vegetated inslope would require additional mowing. However, since virtually all inslopes except those described above, support some vegetation, the amount of mowing required would remain relatively unchanged. In many of the more arid regions of the state, the desired grasses may not require mowing in a given year. In addition, the anticipated reduction in weeds may encourage more private mowing.

4. The MDT currently reimburses counties for cost associated with weed control within highway rights-of-way. The MDT does not audit the counties' expenditures and we do not believe the amount of reimbursements will decrease as a result of establishing vegetation on the gravel inslope.

5. The standard right-of-way widths presently used by the MDT are typically greater than the existing widths. Consequently, the amount of land area within the right-of-way, per mile of road will increase. This increase in land area owned by the MDT puts additional monetary pressures and personnel responsibilities on the MDT Maintenance Division. The importance of suppressing initial weed establishment becomes even more critical when viewed in this context.

<u>Conclusions & Recommendations</u>

1. We recommend that on all projects that involve widening or reconstruction of the base course gravels, available topsoil and seed should be placed on the gravel inslope to promote the establishment of a beneficial vegetative cover, wherever the adjacent terrain does not preclude

the establishment of vegetation.

2. We have determined that a single practice for surfacing inslopes may not fit all conditions. Some areas will not sustain vegetation due to site conditions or required maintenance operations.

3. The effect the adjacent terrain such as rock faces and naturally occurring soils will have on the establishment of vegetation on the gravel inslope should be determined during the field review process during the project's development.

4. The placement of topsoil on the gravel inslope will not "trap" moisture in the gravel base. Since the material that is presently used to construct gravel bases is not free-draining, the moisture that does reach the edge of the base will be removed more quickly through the vegetation's evapotranspiration than through evaporation.

   Free-draining material would require separation fabric and designed outfalls. As such, placing topsoil on gravel inslopes would not interfere with its use.

5. Maintenance activities will not adversely affect the establishment of a desirable vegetation on the surfacing inslope, except where shoulder work occurs with some regularity. On new projects, the location and limits of these areas should be determined and the effectiveness of establishing vegetation should be evaluated.

   The establishment of vegetation will not result in more extensive mowing, since this area becomes vegetated after construction and requires mowing in any case.

6. The reimbursement cost of county weed control will probably not be reduced as a result of vegetating the gravel inslopes. We believe the establishment of desirable vegetation will result in more effective weed control.

7. The costs associated with the placement of topsoil and seeding the gravel inslope = $0.16 - $0.20 per square foot. This equates to $8,700 per acre or approximately $25,000 per mile. The Construction Bureau has determined that the additional traffic control cost for the topsoil operation would be minor.

<u>Recommendations For Further Study</u>

1. We believe that more information should be obtained concerning the movement, particularly lateral movement of moisture in gravel bases. This information could

aid in design and materials that result in more effective subsurface drainage or increased surfacing longevity.

2. We recommend that the MDT study the contamination of base with fines. Would topsoil accelerate the contamination of the base. Is the contamination from the inslope as critical as contamination from the subgrade or that which may occur through pavement cracks. What other variables play a role in the rate and extent of contamination.

3. We recommend that more guidance be given concerning the use of millings. Is placement of millings on the inslope or a portion of the inslope practical. Are other uses such as recycling, shoulder gravel or placement on frontage roads a more beneficial use.

4. Research should be conducted concerning tire plowing in soft soils and the relationship to the vehicles' tripping mechanism. The research should include any other safety factors that may be influenced by the application of topsoil to the surfacing inslope.

5. The MDT should investigate the use of truly free-draining bases. Many states use a thin layer 4"(±) of free-draining material below the asphalt or concrete surfacing.

References:

(1) Transportation Research Record 1326

(2) Transportation Research Board, 1995
The Risk of Rollover in Ran-off-Road Crashes

(3) Transportation Research Board, 1984
The Influence of Roadway Surface Discontinuities on Safety