Merging Tapers, Shifting Tapers,
One-Lane Two-Way Traffic Tapers, and Diversions
Revised 4/23/18

The purpose of this guidance is to provide MDT field crews and Transportation Management Plan (TMP) teams with help in designing, laying out, and constructing merging tapers, shifting tapers, one-lane two-way traffic tapers, and diversions. The purpose of roadway tapers is to move traffic laterally from one path to another. Tapers are usually located in the transition and termination area of the temporary traffic control zone.

Merging Tapers

Merging tapers move traffic laterally from the normal lane to an adjacent lane of traffic at prevailing highway speeds. Merging tapers require the longest taper lengths because drivers are required to merge into a common road lane. An example of a merging taper is one used on an interstate highway lane closure where two lanes are required to "merge" into one. A merging taper should be long enough to enable merging drivers to have adequate advanced warning and time to merge into a single lane before the end of the transition.

A shoulder taper may be beneficial on interstate highways where shoulders are part of the activity area and closed, where the placement of traffic control devices such as arrow boards are in the shoulder area, and where improved shoulders could be mistaken as a driving lane. Shoulder tapers, if used, should have a length of approximately 1/3 the length of the merging taper (from Section 6C.08 and Table 6C-3 of the 2009 Edition of the MUTCD).

Factors involved in calculating lengths of merging tapers are the posted highway speed and the lane width. The method for determining the minimum length of a merging taper is: (from Section 6C.08 and Table 6C-4 of the 2009 Edition of the MUTCD)

For speeds 45 mph or greater, L = W x S
For speeds 40 mph or less, L = (W x S x S) / 60

Where: L = length of the taper in feet
W = width of the lane in feet
S = posted speed limit

Example calculations for a merging taper would be as follows:

1. Lane Width (W) = 12 feet Posted Speed Limit (S) = 75 mph
   Length (ft) = W x S = 12 x 75 = 900 feet

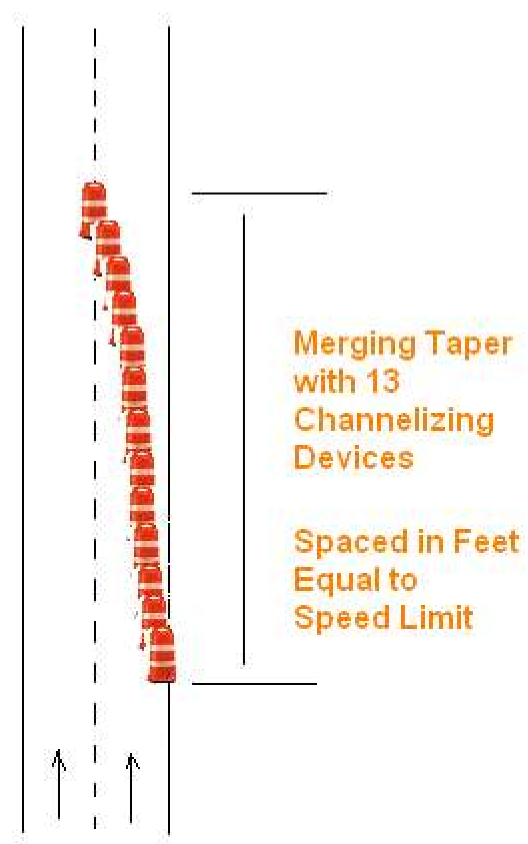
2. Lane Width (W) = 12 feet Posted Speed Limit (S) = 40 mph
   Length (ft) = (W x S x S) / 60 = (12 x 40 x 40) / 60 = 320 feet

While calculating a merging taper length using the appropriate formula is relatively simple, engineering judgment is required when applying the results. Taper lengths may need adjusting when based upon the roadway alignment, when used near interchange ramps to provide for adequately separate decision points, location of approaches, and if merging problems are evident.

The maximum spacing between channelizing devices within a merging taper, in feet, is equal to 1.0 times the speed limit in miles per hour. For example, the maximum spacing of devices is 75 feet at a speed limit of 75 mph. The minimum number of devices in a merging taper equals 13 at all speeds. Adding channelizing devices spaced closer together is appropriate if the Project Manager decides they are necessary based upon engineering judgment.

Example: As previously calculated, at 75 mph and a lane width of 12 feet, the length of a merging taper is 900 feet. Channelizing device spacing is 75 feet. Therefore, the number of channelizing devices = 900 / 75 = 12, plus one for the end of the taper equals 13 channelizing devices.

Merging Taper



Shifting Taper
The shifting taper moves through lanes onto an alternate path but does not reduce the number of lanes. An example of a shifting taper is one used to move traffic around a temporary obstacle such as a bridge replacement or culvert installation. A shifting taper is approximately one-half the length of a merging taper. If more space is available, a longer than minimum shifting taper length may be beneficial.

The factors involved in determining the minimum length of a shifting taper also include the posted highway speed. However, the factor W is the lateral shift distance. This distance is the measured from centerline of the existing PTW to the centerline of the roadway through the diversion. Construction constraints normally restrict the length of the shifting taper to the minimum length. The distance between the obstacle and the edge of the shifted roadway will also be dependent on field conditions. The method for determining the minimum length of a shifting taper is: (from Section 6C.08 and Table 6C-4 of the 2009 Edition of the MUTCD)

For speeds 45 mph or greater, L = ½ (W x S)
For speed 40 mph or less, L = ½ [(W x S x S) / 60]

Where: L = length of the shifting taper in feet
W = width of lateral shift
S = posted speed limit

Example calculations for a shifting taper would be as follows:

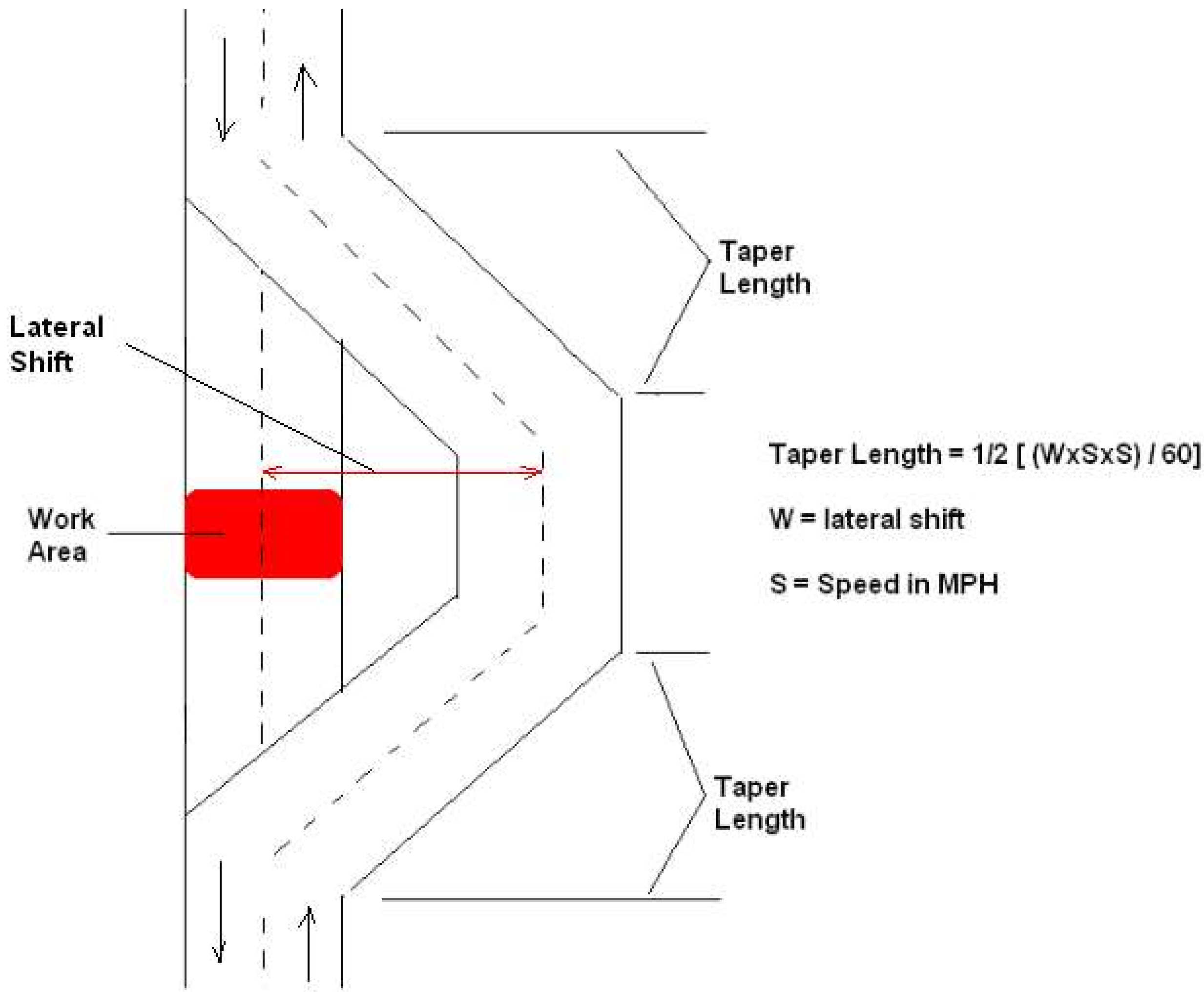
1. Lateral Shift Width (W) = 30 feet Posted Speed Limit (S) = 45 mph
   Length (ft) = ½ (W x S) = ½ (30 x 45) = 675 feet

2. Lane Width (W) = 30 feet Posted Speed Limit (S) = 25 mph
   Length (ft) = ½ [(W x S x S) / 60] = ½ [(30 x 25 x 25) / 60] = 160 feet

The use of engineering judgment is especially important in determining shifting taper lengths. The critical factor in the taper length is the lateral shift distance. Keeping the lateral shift at a minimum while still offering a safe distance between the work area and the edge of the roadway will provide a proper taper length.

Refer to the illustration on the following page for graphical representations of the factors involved in the calculations. Maximum spacing for channelizing devices is the same as that for merging tapers. The maximum spacing in feet is equal to the speed in mph.

Shifting Tapers and Diversions



Diversions
A diversion, sometimes referred to as a shoo fly, is a temporary rerouting of road users onto a temporary alignment placed around the work area such as a bridge replacement or culvert installation. Diversions are usually short term lasting one to three days but can be long term such as when used with a bridge replacement. A detour is a temporary rerouting of road users onto an existing highway to avoid a temporary work area. The terms diversion and detour are often used interchangeably on MDT projects, but, be aware, they are technically different.

Type 2 Object Markers along with channelizing devices may be required through the diversion. Please refer to the guidance for use of Type 2 Object Markers at http://www.mdt.mt.gov/other/webdata/external/const/wzsm/use-of-type-2-object-markers.pdf

One-Lane Two-Way Traffic Taper

One-lane two-way traffic tapers indicate closure of a portion of the roadway so that the remaining roadway must accommodate traffic in both directions. Placement of a one-lane two-way traffic taper is in advance of an activity that occupies part of a two-way roadway. The activity requires closure of a portion of the roadway so that the remaining roadway must accommodate traffic alternately in both directions. The purpose of this taper is to alert drivers of potential head-on conflicts with a one-lane two-way traffic pattern. Typically, flaggers or temporary traffic signals control traffic. The function of this taper is not to merge traffic but to stop traffic by giving the appearance of restricted alignment.

A one-lane two-way traffic taper is 50 feet to 100 feet maximum in length. Spacing of channelizing devices is a maximum of 20 feet. The one-lane two-way taper requires a minimum of 5 channelizing devices.

One-Lane Two-Way Traffic Taper