

## SECTION 650 Pavement Marking and Delineation

### 650.1 Materials

The current list of acceptable pavement marking products is located on the [APL](#). The contractor needs to choose specific materials based on field conditions and conform to manufacturer's installation requirements.

### 650.2 Equipment

Marking equipment should be able to heat liquid markings to the temperature the marking manufacturer specifies. For wet reflective/recoverable markings, a double drop system is required. The equipment should be able to report all information needed to complete a [DT2130](#) and/or [DT2131](#).

### 650.3 Locating Pavement Markings

#### 650.3.1 General

The project engineer should review the proposed locations before markings are applied. Questions may be directed through the project engineer to the region traffic engineer.

On resurfacing contracts where there is no change in either horizontal or vertical alignment, and which do not contain a separate Locating No Passing Zones bid item, the contractor is responsible for referencing the beginning and end of all existing no passing zones. This must be done before the start of construction operations that will destroy existing markings.

On contracts that contain changes in horizontal or vertical alignment the contractor is responsible for establishing the beginning and end of no passing zones under the Locating No Passing Zones bid item. The contractor should reference the beginning and end of newly located no passing zones on intermediate layers, so these locations only have to be established once. Locating no passing zones for the final surface must be done when paving is complete.

For roadways with speed limit changes, maintain the proper no passing zone sight distance.

- For locations where the posted speed limit is increasing: When the lead vehicle reaches the speed limit sign, the trail vehicle would back up to the appropriate no passing zone sight distance.
- For locations where the speed limit is decreasing: When the trail vehicle reaches the speed limit sign, the lead vehicle would back up to the appropriate no passing zone sight distance.

#### 650.3.2 Locating No Passing Zones Checklist

Locating No Passing Zone Checklist based on [standard spec 648](#).

1. Project personnel responsible for inspecting marking should contact the Regional Pavement Marking Coordinator for special zones at least one month before locating no passing zone work takes place.
  - Are there any special zones and have they been placed according to the project special provision?
2. Have contractor personnel checked with the project engineer before beginning work?
3. Is equipment required under [standard spec 648.3.2](#) on the spotting vehicle?
4. Are the marks locating the ends of the no passing zones legible and durable (white marks on asphalt and black marks on concrete)? Is the backup lath placed away from any construction activity?
5. Are barrier lines located as specified in [standard spec 648.3.2](#), the department's traffic engineering, operations & safety manual policy 3-2-2 and the plans?
6. Are the no-passing zones leading into and out of the project limits correct, according to [standard spec 648.3.2](#) and the department's traffic engineering, operations & safety manual policy 3-2-2?
7. Is the line of sight within the shoulder, avoiding future vegetation growth or obstructions?
8. Is the minimum distance between the zones available or do the zones need to be closed?
9. Did the No-Passing Zone log ([DT2124](#)) include the following?
  - Date of Survey.
  - Cardinal direction of travel.
  - Sight distance used and posted speed for each zone.
  - Entries logged from west to east on east-west roads and entries logged from south to north on north-south roads.
  - Location of geographical features such as side roads, county and regional boundary lines, and starts and ends of bridges.
  - Locating features to the 1/100 of a mile for each road surveyed.
  - The beginning and ending of each no-passing barrier line in both directions.
10. Did the contractor provide 4 copies of the No-Passing Zone log to the Regional Pavement Marking Coordinator and send an electronic copy to the BTO Marking inbox (DOTBTOMarking@dot.wi.gov)?

### 650.3.3 Locating Curves

- Horizontal curves: Do not extend the line of sight outside the grass/gravel shoulder. Locate no passing zones on the inside radius of horizontal curves and record the no passing zones in the cardinal direction.
- Crest vertical curve: When the target light on the lead vehicle goes out of sight, the trail vehicle parks at the base of the hill, back the lead vehicle up to reveal a full silhouette of the car (from the bottom of the bumper up). Once the trail vehicle sees the full silhouette of the lead vehicle, establish the appropriate sight distance between the 2 vehicles before continuing spotting.
- Sag vertical curves: When the target on the lead vehicle goes out of sight, stop the lead vehicle at the base of the hill or in the sag, pull the trail vehicle forward until the full silhouette of the lead vehicle is visible. Once the trail vehicle sees the full silhouette of the lead vehicle, establish the appropriate sight distance between the 2 vehicles before continuing spotting.

### 650.4 Application

Temporary traffic control and flagging requirements are discussed in [CMM 145](#). Personal safety requirements are in [CMM 135](#).

The contractor is responsible for locating required temporary and permanent pavement marking, including the beginning and end of no passing zones, unless the contract specifies otherwise.

#### 650.4.1 Temporary Markings

*Revise 650.4.1 to remove some information and add guidance relating to removal of permanent pavement markings.*

[Standard spec 649.3](#) requires same-day temporary longline pavement markings on pavements or surfaces open to traffic the same day the pavement layer is placed, or the surface is milled, except when adverse weather conditions preclude marking.

The traffic control contractor must coordinate with the permanent pavement marking contractor to ensure complete removal of lines **that are not in the same locations as the permanent marking**.

Temporary markings should be installed on any temporary surface or where the marking will be removed before the permanent marking is installed.

#### 650.4.2 Same Day Pavement Marking

[Standard spec 646.3.2.5](#) allows the contractor to use temporary pavement marking to meet the permanent same-day requirement on upper layers. If the contractor chooses this option, temporary marking must be completely removed before placing permanent pavement marking. Costs associated with this option are incidental to the associated Marking Line Same Day bid item.

Under the Marking Same Day bid item, [standard spec 646](#) requires same day long-line permanent pavement markings on pavements open to traffic on the same day the upper layer is placed, unless adverse weather conditions preclude marking.

Same day pavement markings are only for necessary longline markings typically used on the upper surface layer placed on conventional two-lane highways that are open to traffic and that have surfaces capable of retaining markings.

Any temporary pavement marking material which meets [standard spec 649.3](#) may be used on the surface course to temporarily mark centerline when the permanent markings are delayed.

#### 650.4.3 Permanent Markings

Pavement markings designated in the contract for removal and any other pavement markings not appropriate to the travel path must be removed. Pavement cleaning may be done by any method that will not damage the pavement, leave a residue or cause discoloration and has a dust control system. The contractor should avoid damage to parked or passing vehicles.

Marking limits should be laid out well in advance of the actual application operation to avoid delay to the marking contractor. Standard notations for delineating the limits should be used and should be coordinated with the marking crews before application. The marking limits and the positioning of special markings are to be checked by the engineer before application.

An initial check of the marking equipment is ideally made at the contractor or municipality's shop on a paint test area. If this is not possible, the initial checks must be made on the project at the start of operations. Placing a nonabsorbent plate on the marked line and applying material without glass beads over it is a good way to check the thickness of the material. Wet thickness may be checked with a depth gauge available through the region. Dry thickness may be checked by a caliper available through the region.

Permanent pavement marking on pavements open to traffic must be applied to the upper layer within 7 days of completing mainline surfacing, unless the contract requires otherwise, or weather conditions preclude such application.

Permanent markings on roads that were closed to traffic during construction must be applied before opening to traffic, unless the engineer allows otherwise.

Markings may be omitted:

- On roadways closed to through traffic, marking is not critical, if barricades and road closed signing are present prior to the road opening.
- On roadways open to traffic, if markings will not be in place for 24 hours or less, install No Center Line and Do Not Pass signs at the beginning of the project and every 2 miles or after county and state intersections. If markings are absent for longer than 24 hours and up to 72 hours, channelizing devices must be placed along with No Center Line and Do Not Pass signs.
- On multilane divided highways, do not open more lanes than are marked. If on a four-lane freeway and two of the lanes are not marked, then only a single lane 12 ft. may be opened. If on a six-lane freeway, and two of the lanes are marked and the third is not, then the third lane must be closed.

#### **650.4.4 Grooving Wet Pavement**

Pavements have very good water retention. Expect water in the grooves if it has rained in the last 48 hours. If water is encountered during grooving, the contractor must allow the groove to completely dry before placing markings. Acceptable options when there is water or dampness in the grooves are:

1. If the roadway is open to traffic and the grooves will not be dry by the time the lane closure is taken down; cut out the grooves then install temporary 4' removable tape with a 46' gap outside of the grooved area. Come back when the grooves are completely dry and install the permanent markings. Remove tape after permanent markings are installed.
2. If cold weather or temporary markings are already placed in the permanent location and you suspect water in the full length of the groove while leaving 4' of the existing marking. Come back when the grooves are dry and install permanent markings. Waterblast the existing markings to help eliminate scarring.

#### **650.4.5 Grooving on Bridge Decks**

A grooved slot on a bridge deck or concrete overlay will not cause structural problems or affect the service life of the concrete.

#### **650.4.6 Placing Epoxy Marking on Polymer Overlay Bridge Decks**

Polymer overlay warranties do not allow any mechanical removal of temporary markings. Only surface applied standard epoxy marking is allowed.

#### **650.4.7 Resealing Protective Surface Treatment on Concrete Bridge Decks**

The contractor can place this treatment in any feasible way. Rolling and spraying are two options. The contractor can use other methods as long as sealant does not cover the marking. Any sealer from the [APL](#) is acceptable. [Standard spec 646.3.1.1](#)(5) requires the contractor to protect markings when resealing to ensure the markings retain their reflectivity, color, and presence.

#### **650.4.8 Cold Weather Pavement Marking**

[Standard spec 646.3.1.3](#) restricts placement of permanent pavement marking at low temperatures since pavement marking adherence is most effective when the markings are placed above 35 F for epoxy and 50 F for tape. This specification may require the marking contractor to place temporary marking over the winter. A higher failure rate of 25 percent is allowed for cold weather pavement marking. Since conditions outside of manufactures specifications do not promote a good bond, the contract requires removal and replacement once weather allows.

#### **650.4.9 Pavement Markings Inspection**

***Revise 650.4.9 groove depth for tape and wet reflective epoxy to match manufacturer's updated recommended depths.***

Project personnel are responsible for inspecting the pavement marking and should contact the Region Pavement Marking Coordinator if any items on the Pavement Marking Checklist are not satisfactory. [Standard spec 646.3.1.5](#) has initial retroreflectivity inspection criteria to be completed 15 to 60 days after installation or before the first snow fall. Do not perform inspections before day 15 since excess beads may still be present and affect the retroreflectivity readings.

Pavement Marking Checklist:

1. Pavement marking coverage
  - Is it uniform throughout the line within the specified mil thickness?
  - Is there a sharp cut off on both sides and ends of the line?
2. Bead coverage
  - Is it uniform throughout the line within the specified pounds per gallon?
  - Viewing the line with the sun behind you makes an initial check of the effective application of glass beads dropped onto the surface. The full width of the line should be covered. There should not be an excessive amount of non-embedded beads.

3. Are the products on the approved products list [APL](#)?
4. Are long-line markings placed according to specifications for width, color, lengths, and cycles?
5. Are special markings placed according to specifications for spacing and layout?
6. Have the temporary lines been removed without leaving a noticeable scar?
7. Grooving
  - Did the contractor provide a copy of the manufacturer recommendations before grooving?
  - Has the contractor ensured that the asphalt can handle the grooving operation?
  - Is the groove edge sharp in appearance? If not, the grooving equipment may need to be changed or in the case of asphalt, the 5-day waiting period isn't long enough.
  - Is the groove clean from fine particles and dry before placement of the permanent marking?
  - Is the groove depth 175 mils for tape and 90 mils for wet reflective epoxy from the pavement surface or from the high point of the tined surface?
  - Is the groove width no more than one inch wider or longer than the permanent marking?
  - Does the groove operation follow the joint curve?
  - Is the groove edge a minimum of 3 inches away from the joint edge according to contract standard detail sheets, typically [SDD 15C8-a](#)?
  - Was the groove dry before markings were placed?
8. Proving Period
  - Are the markings following the minimum criteria listed?
  - Contact Regional Pavement Marking Coordinator as soon as possible if there are any questions of pavement marking performance issues. The Region Pavement Marking Coordinator will take retroreflectivity readings upon request. Send a copy of any retroreflectivity data captured by the Regional Pavement Marking Coordinator or contractor to the BTO Marking inbox ([DOTBTOMarking@dot.wi.gov](mailto:DOTBTOMarking@dot.wi.gov)).
  - Pay attention to marking placed on High Early Concrete since the hydrostatic pressure may cause a premature marking failure.

### 650.5 Protection of Fresh Markings

The approximate times for approved marking materials to dry to a no-tracking condition under optimum conditions of air temperature, pavement temperature and humidity, can be found in the manufacturer's specifications.

It is necessary to protect slower drying materials, including epoxy, from tracking by vehicles. One or more of the following methods may be used, depending on traffic volume, crossing movements and drying time:

1. Traffic cones at 100' spacing.
2. A convoy of moving vehicles.

### 650.6 Delineator Posts

Delineator checklist based on [standard spec 633](#).

1. The project personnel responsible for inspecting the delineators should contact the Regional Pavement Marking Coordinator at least one month before placement.
2. Are the steel delineators placed according to specification for reflector color, quantity of reflectors, and spacing and layout of the posts?
3. Are the flexible delineator posts placed according to specification for color of sheeting, and spacing and layout?

### 650.7 Measurement and Payment

Payment may be required for marking that falls within the project scope but is beyond the project limits. There are times when center line remarking is needed beyond the project limits to ensure the project and adjoining roadway works together within the current standards for locating no-passing zones. This may occur when:

- The project alignment has changed.
- No-passing zone standards are modified, thereby closing a previously marked carry over zone.
- Or when 500' barrier lines were added to a project thereby closing a carryover zone.

These changes could require the closing of passing zones on one or both ends of the project. When this occurs, measure and pay for Locating No-Passing Zones and for the center line 6" marking required beyond project limits. The quantity required outside of the project limits will never exceed four times the minimum distance between zones.