



## 6-50.1 Materials

### 6-50.1.1 Permanent Markings

Approved materials are solvent borne and waterborne paint, epoxy, preformed thermoplastic and preformed plastic. The approved solvent-borne and waterborne paint formulations are selected from department performed tests. This list can be accessed through the department's approved products list at:

<http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/tools/appr-prod/default.aspx>

Glass beads are dropped or sprayed onto the wet paint immediately after application of the marking material to the pavement to produce a reflective condition. The term for this application is called drop-on.

The rates of application of this application are set forth in the specifications or the special provisions for the individual contract.

Samples and certification requirements for the beads, paint and epoxy are found in [standard spec 646.2](#).

#### 6-50.1.1.1 Grooving Preformed Plastic Tape on Bridge Decks

Preformed Plastic Tape placed in a grooved 120 mils slot on a bridge deck or concrete overlay will not cause structural problems, or affect the service life of the concrete. Whenever an anti-ice overlay and preformed plastic tape are called out on a project, the warranties of both products will not be invalidated as long as both the overlay and marking vendor are in agreement with the installation procedures.

Whenever short bridge pavement approaches to bridge decks are constructed as part of bridge rehabilitation, place the same type of marking as leading up to the bridge deck.

#### 6-50.1.1.2 Placing Epoxy Marking on Epoxy Overlay Bridge Decks

Epoxy overlay warranties do not allow any mechanical removal of temporary markings so only permanent epoxy marking is allowed.

#### 6-50.1.1.3 Removing and Resealing Protective Surface Treatment on Concrete Bridge Decks

Standard spec 646.3.1 requires removal of protective surface treatment before placing pavement marking and resealing the removal area after placing the marking. The contractor can place this treatment in any feasible way. Rolling, spraying are two options. Any sealer from the approved products list is acceptable.

#### 6-50.1.1.4 Late Season Pavement Marking

Standard spec 646.3.1 restricts placement of permanent and temporary pavement marking from November 15 through April 15 since pavement marking adherence is best when applied above the pavement temperature of 40 degrees Fahrenheit. This specification requires the marking contractor to place temporary marking over the winter. A higher failure rate of 25 percent is allowed than what is called out in 646.3.3.4 since pavement conditions during the winter months do not promote a good bond. The late season marking will be removed after April 15 unless the engineer allows otherwise.

This product can be from any of the pavement marking approved products lists.

The application rate should follow [standard spec 649.3.2](#).

All work is incidental to the permanent marking bid item.

Exception- When STSP 646-010, and item 646.0900.S are included in the project, the department will pay for late season marking. This is included on all projects projected to be completed after November 15 and when multi-year projects require pavement markings to be placed between November 15 and April 15.

### 6-50.1.2 Temporary Markings

Temporary pavement markings include removable tape, reflectorized paint, non-removable reflectorized tape and temporary raised pavement markers. They must conform to the requirements of [standard spec 649.2.2](#) through [standard spec 649.2.5](#).

Wet reflective removable tape conforms to the requirements of [standard spec 649.2.2](#).

Grooved wet reflective removable tape conforms to the contract special provisions when the construction stage is in effect during the winter. When grooved on temporary pavement surfaces, this practice will avoid grooving permanent surfaces at locations where the temporary marking does not coincide with the location of the

permanent marking.

Removable tape is similar to non removable reflectorized tape but has the capability of adhering to the pavement throughout the construction season under all climatic and traffic conditions and then being easily removed intact or in large pieces, without residue and without grinding, blasting, or solvents. Its greatest use is on surface courses where revisions in traffic flow are necessary and where removal must be easily and quickly accomplished without a trace such as on bridge decks.

Black removable tape is used to cover pre-existing pavement marking. Reflectorized paint is commercial traffic marking paint that obtains reflectorization through dropping or spraying glass beads onto the paint. Its greatest use is on binder or lower courses, other surfaces which will be covered or removed, or when the temporary marking location coincides with the location of the future permanent marking.

Temporary raised pavement markers supplement temporary pavement marking lines in shifts, crossovers, temporary lanes, and bypasses where wet reflective removable tape is not being used, especially on higher-speed roadways.

Wet reflective removable tape is used alone as temporary pavement marking lines in shifts, crossovers, temporary lanes and bypasses.

### 6-50.1.3 Same Day Pavement Markings

For marking location conform to [standard spec 646.3.1](#). For epoxy materials conform to [standard spec 646.2.4](#). For high contrast raised patterned tapes or 4 inch raised patterned tapes conform to the contract special provisions materials subsections.

Same day pavement markings are only for centerlines, including no-passing zones on the upper surface layer placed on conventional two-lane highways that are open to all traffic and that have surfaces capable of retaining markings. These markings are placed the same day the existing markings are obliterated or when the upper surface layer is placed.

### 6-50.2 Equipment

#### 1. Solvent borne and Waterborne Acrylics

These are normally applied with truck-mounted equipment. The paint is heated to a temperature recommended by the manufacturer. The heat should be uniformly maintained during the application operation. Continuous mixing and agitation should be provided. The paint tank should have a calibrated dipstick for measuring the quantity of paint.

#### 2. Epoxy

This material is generally sprayed on at temperatures according to manufacturer recommendations. Relief valves and an automatic thermostat are to be provided to maintain a constant temperature level through all applicator components and to prevent overheating and possibility of explosion. A means for continuous mixing and agitation is to be provided.

#### 3. Glass Beads Dispenser

This unit must be equipped with an automatic cutoff synchronized with the cutoff for the marking material.

Non-removable reflectorized tape is commercial traffic marking tape. It usually requires extensive effort to remove the tape since blasting, grinding, heating, burning, or solvents can leave detrimental marks or residue which will mislead traffic. It is generally not used on surface courses, except at specific described locations. Its greatest use is found on binder or lower layer courses, or other surfaces to be covered or removed.

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### 6-50.3 Locating Pavement Markings

Pavement markings are to be located by the contractor as the plans show, by special provisions, or as directed by the engineer.

The manager should review the proposed locations prior to the markings being applied. Questions may be directed through the engineer to the region traffic engineer. The engineer's review should include material types, colors, locations, widths, width tolerances, positioning tolerances, sequencing or staging, special installations and omitted markings that may require change orders.

[Standard spec 648.3.2](#) states the procedure for submitting spotting log sheets to construction personnel. Two of the three copies should be forwarded to the Bureau of Highway Operations by the region.

#### 6-50.3.1 Locating No Passing Zones

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

1. The project personnel responsible for inspecting the 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 the two locating no passing zone spotting contractor personnel reported to the project engineer prior to work?
3. Is the required equipment as per [standard spec 648.3.1](#) on the spotting vehicle?
  - 2 vehicles that place the observer's eye height at 42" above the pavement?
  - A target light mounted at 42" above the roadway and offers a sharp cut off when it disappears and reappears. Example would be a flashing light.
  - Are both vehicles equipped with:
    - Warning lights consisting of a full-width flashing yellow light bar with 360 degree visibility.
    - Distance Measuring Instruments, accurate to 10 feet in 1 mile per spec. Ability to subtract when traveled in reverse.
    - Two- way communication between vehicles.
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 according to [standard spec 648.3.2](#), the department's traffic guidelines 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 guidelines 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 contractor provide ~~hand over~~ 4 copies of the completed No-Passing Zone log ([DT2124](#) form) with the following items?
  - 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 3 copies of the completed No-Passing Zone log ([DT2124](#) form) to the Regional Pavement Marking Coordinator.

## 6-50.4 Application

### 6-50.4.1 Permanent Markings

The approved types of pavement marking materials are to be placed at or above the following minimum pavement temperatures, expressed in degrees Celsius, and the following minimum initial wet thicknesses, expressed in mils, unless a rate of application is provided for in the contract:

	Minimum Pavement Temperature, F	Minimum Wet Film Thickness, mils
Waterborne Paint	50	15
Epoxy	35*	15, 20**, 25***
Preformed Plastic Tape	****	
Preformed Thermoplastic	****	

\* May be placed at cooler temperatures. Refer to [standard spec 646.3.3](#) for conditions to be satisfied.

\*\* For new seal coat surfaces, newly tined concrete and new stone matrix asphalt. Prepare the stone matrix asphalt surface similar to new concrete surface.

\*\*\* For SMA pavement and epoxy overlay surfaces.

\*\*\*\* Place according to manufacturer's recommendations.

[Standard spec 646.3.1](#) states the pavement surface requirements for the marking to adhere properly. 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, symbols, and markers 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 prior to application. The marking limits and the positioning of symbols and markers are to be checked by the engineer prior to 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. Signing requirements are discussed in [CMM 1-45](#). Flagging and personal safety requirements are set forth in [CMM 1-35](#).

On highways open to traffic, refer to [standard spec 646.3](#) and contract standard detail sheets, typically SDD 15C19-a, b and c, for convoy requirements.

#### 6-50.4.2 Pavement Markings Inspection

This checklist based on [standard spec 646](#):

1. The project personnel responsible for inspecting the marking should contact the Regional Pavement Marking Coordinator at least one month before placement.
2. 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?
3. 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.

4. Long line markings-
  - Are they placed according to specifications for width, lengths, and cycles?
  - Has the temporary lane line been placed in the same location as the permanent preformed plastic tape?
  - Has the temporary lane line been removed by the grooving operation for the lane line preformed plastic tape?
  - Preformed Plastic Tape Grooving
    - Did the contractor provide a copy of the manufacturer recommendations prior to 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 prior to placement of the preformed plastic tape?
    - Is the groove depth 120 mils from the pavement surface, or if tined, from the high point of the tined surface?
    - Is the groove width one inch wider than the preformed plastic tape?
    - Does the groove operation follow the joint curve?
    - Is the groove edge of the preformed plastic tape at a minimum of 6 inches away from the joint edge as per contract standard detail sheets, typically SDD 15C8-a?
    - Is the groove edge of the preformed plastic tape a minimum of 4 inches, but not greater than, 12 inches from both ends of the pavement marking segment?

5. Special markings

- Are they placed according to specifications for spacing and layout?
  - Is the groove edge of the marking at a minimum of 3 inches away from the joint edge?
6. Temporary markings
- Are they placed according to specifications for spacing and layout?
  - Are they completely removed as required without leaving noticeable scars to the pavement?
  - Was temporary tape utilized on the final layer of pavement whenever possible for crossover, tapered areas, and bridge decks?
7. Certification Papers
- Are the products listed in the approved products lists?
8. Proving Period
- Are the markings following the minimum criteria listed as per [standard spec 646.3.3.4](#)?
  - Contact Regional Pavement Marking Coordinator as soon as possible if there are any questions of pavement marking performance issues.
  - Pay attention to marking placed on High Early Concrete since the hydrostatic pressure may cause a premature marking failure.

#### 6-50.4.3 Delineator Posts

This 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?

#### 6-50.4.4 Temporary Markings

[Standard spec 649.3.1](#) requires that temporary pavement markings shall be placed as shown on the plans on asphaltic binder courses or lower layers or surface courses open to traffic, on the same day such courses are placed, unless weather precludes or a permanent marking will be placed the same day as the asphalt is placed.

When pavement surfaces are milled, an unmarked surface used for traffic must be temporarily marked unless permanent markings are applied the same day as the milling is done, or unless weather prevents.

The contractor must coordinate the application of both the temporary and permanent markings to eliminate covering of the temporary markings with the permanent markings, except in no-passing zones.

The traffic control contractor must coordinate with the grooved wet reflective tape contractor to ensure complete removal of the temporary lane lines by placement of the tape.

The temporary markings need not be removed when applied substantially on the same alignment as the permanent markings and are otherwise acceptable, unless removal is required by the contract. If removal is required, 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.

Scarring has occurred in the past on bridge decks despite care in removal. Utilize removable tape whenever possible to avoid any potential scarring.

Temporary pavement markings should be applied in accordance with the manufacturer's instructions and with [standard spec 649.3](#).

Temporary raised pavement markers which meet [standard spec 649.2.1](#) may supplement temporary marking lines in shifts, crossovers, temporary lanes, and bypasses where wet reflective removable tape is not being used.

Wet reflective tape is used alone as temporary pavement marking lines in shifts, crossovers, temporary lanes and bypasses.

#### 6-50.4.5 Same Day Pavement Marking

[Standard spec 646.3.1](#) permits the contractor to delay the application of the permanent markings beyond the specified time provided he applies temporary pavement markings.

Any temporary pavement marking material, removable tape, (except for black or wet reflective tape) reflectorized paint or non-removable reflectorized tape which meets [standard spec 649.2.1](#) may be used on the

surface course to temporarily mark centerline when the permanent markings are delayed.

### 6-50.5 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, are as follows:

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

1. Traffic cones;
2. A convoy of moving contractor or department-owned vehicles;
3. Saturation of the surface with glass beads.

The necessary spacing of traffic cones will range from a minimum of 50 feet in high-volume, high crossing incidence areas, to a maximum of 250 feet in lesser-traveled areas. The use of a convoy should include a plan of operation, an informational meeting for all involved personnel prior to field operations and provision for communication between the marker unit and the first and last trucks in the convoy, as a minimum.

Saturation of the fresh markings with glass beads may produce an excess of glass beads not embedded in the marking material. Any excess that presents a slippery-pavement hazard to traffic should be removed from the pavement immediately after the marking has dried to a no-track condition.

### 6-50.6 MEASUREMENT AND PAYMENT

Payment for waterborne paint, epoxy, and glass beads is based on placing at a specified rate. The engineer should receive from the contractor the initial and final paint tank dipstick readings, recorded additional paint added to the tank during the marking operation and amount of glass beads used. Checks should be made periodically to assure the thickness requirement is being met.

[Standard spec 646.4](#) states payment for removal of markings will be by the lineal foot of 4-inch wide line. Equate one foot of 4-inch line to 1/3 square foot of irregular marking not covered in [standard spec 647.5](#).

Payment for all types of permanent pavement markings is based on a proving period specified in [standard spec 646.3.3.4](#).

Payment for temporary pavement markings including removable tape, including black masking and wet reflective tape, reflectorized paint, non removable reflectorized tape, and temporary raised pavement markers can be found in [standard spec 649.5](#).

Payment for grooved wet reflective tape will be paid as stated in the contract special provisions.

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 an existing carry over zone since the road was previously marked,
- 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, pay for Locating No-Passing Zones and for the 4" epoxy marking required beyond project limits. The quantity required outside of the project limits will never exceed four times the minimum distance between zones shown in [standard spec 648.3.2\(2\)](#).