The cost of the pole; lowering system including winch assembly, power cable, and support cable; concrete pad; luminaire ring; anchor bolts and nuts; lightning rod assembly; grounding system; and all incidental materials necessary to complete the installation shall be included in the cost of high mast tower. The cost of excavation, concrete, sleeves for cable-duct, non-metal pipe, reinforcing bars, backfill, finish grading, and sodding shall be included in the cost of lighting foundation.

The cost of wood poles, multiple relay switches, service cabinet, photocells, photocell receptacles, weatherhead, conduit, and other miscellaneous items shall be included in the cost of the service point.

The cost of lamps, LED arrays, plasma emitters, drivers, optical systems, weatherproof housings, surge protection devices, electrical connections, and installation of the luminaire on the pole shall be included in the cost of luminaire.

The cost of snap-on coverings in light pole bases and waterproof coverings in underground handholes shall be included in the cost of multiple compression fitting.

The cost of maintaining highway illumination during the life of the contract and the preparation and transmittal of as-built drawings shall be included in the cost of other pay items.

SECTION 808 – PAVEMENT TRAFFIC MARKINGS

808.01 Description

This work shall consist of furnishing and installing, or removing, pavement traffic markings and snowplowable raised pavement markers in accordance with the MUTCD, these specifications and as shown on the plans. Markings shall be installed as required unless written approval is obtained from the District Traffic Engineer to make modifications at specific locations.

MATERIALS

808.02 Materials

Materials shall be in accordance with the following:

Beads	921.02(e)
Cones	801.08
Multi-Component	921.02(c)
Preformed Plastic	921.02(b)
Snowplowable Raised Pavement Markers	921.02(d)1
Thermoplastic	921.02(a)

A Certification, Other, in accordance with 916, shall be provided by the manufacturer that certifies the paint meets all IDEM and EPA regulatory requirements for VOC levels and lead, chromium or other heavy metals.

CONSTRUCTION REQUIREMENTS

808.03 General Requirements

Permanent pavement markings shall be placed on the surface course in a standard pavement marking pattern. Center lines shall be placed on two-way two-lane roads, lane lines shall be placed on multi-lane divided roads, and both center lines and lane lines shall be placed on multi-lane undivided roads.

The pavement shall be cleaned of all dirt, oil, grease, excess sealing material, excess pavement marking material and all other foreign material prior to applying new pavement traffic markings. New paint pavement markings may be placed over sound existing markings of the same color. New thermoplastic, preformed plastic, or multi-component markings may be applied over sound existing markings of a compatible type if allowed by manufacturer's recommendations, a copy of which shall be supplied to the Engineer prior to placement; otherwise, existing markings shall be removed in accordance with 808.10 prior to placement of the new markings. Removal of pavement marking material shall be in accordance with 808.10. The pavement surface shall be dry prior to applying pavement traffic markings.

Control points required as a guide for pavement traffic markings shall be spotted with paint for the full length of the road to be marked. Control points along tangent sections shall be spaced at a maximum interval of 100 ft. Control points along curve sections shall be spaced so as to ensure the accurate location of the pavement traffic markings. The location of control points will be subject to approval prior to the pavement traffic marking application.

808.04 Longitudinal Markings and Milled Corrugations

All longitudinal lines shall be clearly and sharply delineated, straight and true on tangent, and form a smooth curve where required. Lines shall be square at both ends, without mist, drip or spatter.

A solid line shall be continuous. A broken line shall consist of 10 ft line segments with 30 ft gaps. A dotted line shall consist of 3 ft line segments with 9 ft gaps unless otherwise indicated on the plans.

All lines shall be gapped at intersections unless otherwise specified or directed.

The actual repainting limits for no-passing zone markings will be determined by the Engineer.

A new broken line placed over an existing broken line shall laterally match the existing broken line, and the new line segments shall not extend longitudinally more

than 10% beyond either end of the existing line segments. A new dotted line placed over an existing dotted line shall laterally match the existing dotted line, and the new line segments shall not extend longitudinally more than 6 in. beyond either end of the existing line segments.

(a) Center Lines

Center lines shall be used to separate lanes of traffic moving in opposite directions. All center line markings shall be yellow in color and 6 in. in width on the state highway system, and 4 in. wide on all other roads. They shall be placed such that the edge of the marking, nearest to the geometric centerline of the roadway, shall be offset 3 in. from the geometric centerline on the state highway system and 3 in. on all other roads unless a different offset is approved by the Engineer.

The center line of a multi-lane roadway shall be marked with a double solid line. The two lines forming the double solid line shall be spaced 6 in. apart on the state highway system, 6 in. apart on all other roads, and shall be equally offset on opposite sides of the geometric centerline unless a different spacing is approved by the Engineer.

The center line of a two-lane, two-way roadway, where passing is allowed in both directions, shall be marked with a broken line.

The center line of a two-lane, two-way roadway, where passing is allowed in one direction only, shall be marked with a double line, consisting of a broken line and a solid line. The broken line and the solid line shall be spaced 6 in. apart on the state highway system, 6 in. apart on all other roads, and shall be equally offset on opposite sides of the geometric centerline unless a different spacing is approved by the Engineer. The solid line shall be offset toward the lane where passing is prohibited. The broken line shall be offset toward the lane where passing is allowed.

The center line shall be placed within the milled corrugation when center line rumble stripes are specified. Placement of the center line marking in the milled corrugation does not alter the pavement marking performance requirements of 808.07.

(b) Lane Lines

Lane lines shall be used to separate lanes of traffic moving in the same direction. Normal width lane line markings shall be white in color and shall be 6 in. wide on the state highway system, and 4 in. wide on all other roads. They shall be offset 4 in. to the right of longitudinal pavement joints or divisions between traffic lanes.

Wide lane lines for lane drops, route splits, or auxiliary lanes shall be white in color and shall be 10 in. wide on the state highway system, and 8 in. wide on all other roads. White solid lines shall be used to mark lane lines only when specified or directed.

(c) Edge Lines

Edge lines shall be used to outline and separate the edge of pavement from the shoulder. Edge line markings shall be 6 in. in width on the state highway system, and 4 in. wide on all other roads. The edge lines shall be placed such that the edge of the marking nearest the edge of the pavement shall be offset 4 in. from the edge of the pavement except as otherwise directed. Right edge lines shall be marked with a white solid line and left edge lines shall be marked with a yellow solid line.

The edge line shall be placed in the milled corrugation when edge line rumble stripes are specified. Placement of the edge line marking in the milled corrugation does not alter the pavement marking performance requirements of 808.07.

(d) Barrier Lines

Barrier lines shall be used as specified or directed. Barrier line markings shall be solid lines of the size and color specified or as directed.

(e) Markings in Retrofitted Corrugations

In sections where corrugations are being placed in the existing surface, all existing pavement markings shall be removed in accordance with 808.10 and any existing sealants shall be removed by routing or grinding. Temporary pavement markings placed in accordance with 801.12 shall be offset a sufficient distance from the longitudinal joint so as to not to obstruct the installation of the corrugations or the application of the liquid asphalt sealant.

The Contractor shall make a record of the existing pavement marking locations so that such markings may be replicated later with the appropriate adjustments for edge line rumble stripes. This record shall show longitudinal and transverse dimensions. The record shall be submitted to, and is subject to approval by the District Traffic Engineer prior to the removal of existing pavement markings. The District Traffic Section shall be notified two weeks prior to applying pavement markings to allow the District Traffic Section time to verify the pavement marking plan.

808.05 Transverse Markings and Pavement Message Markings

(a) Transverse Markings

Transverse marking lines shall be used as specified or directed to delineate channelizing lines, stop lines, crosswalk lines, and parking lines. Parking lines for ADA accessible parking spaces shall be 4 in. wide and blue in color. Unless otherwise specified or directed, all other parking lines shall be 4 in. wide and white in color. All other transverse markings shall consist of all necessary lines, of the width specified or directed and shall be in accordance with the MUTCD.

(b) Pavement Message Markings

Pavement message markings shall be used as specified or directed for railroad crossing approaches, intersection approaches, crosswalk approaches, ADA accessible parking space symbols, and other messages applied to the pavement with pavement

marking material. The markings shall consist of all necessary lines, words, and symbols as specified or directed, and shall be in accordance with the MUTCD.

808.06 Curb Markings

Curb markings shall consist of reflectorized paint which shall cover the face and top of the curb.

The existing curb and gutter area shall be cleaned of dirt, dust, oil, grease, moisture, curing compound, and unsound layers of other materials before paint is applied to the curb surface.

808.07 Pavement Marking Material Application, Equipment, and Performance Requirements

All double line markings, such as a no passing zone or the center line of an undivided multi-lane roadway, shall be applied in one pass. When a hand-propelled machine is used, the single pass application of double line markings will not be required and control points shall be spaced at a maximum of 10 ft longitudinally.

For contracts with completion dates when conditions do not enable application of the specified marking materials, or grooving for durable marking materials, other materials may be substituted with an appropriate unit price adjustment if approved by the Engineer.

Markings shall be installed in accordance with the manufacturer's recommendations, except that the minimum requirements stated herein shall also apply. Products specifically designed for application temperatures below the stated minimums herein are not required but may be used if approved by the Engineer.

When directed, the Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals prior to beginning installation work, and no installation work shall begin prior to the Department's receipt of these manuals. These manuals shall become the property of the Department.

The markings shall be protected from traffic until dry to eliminate tracking.

The markings shall meet or exceed the following performance criteria:

1. Color. The daytime and nighttime color of the applied markings shall be in accordance with ASTM D6628 when determined in accordance with ASTM E811 and ASTM E1349.

2. Durability. The pavement markings shall have a minimum resistance to wear of 97% in accordance with ASTM D913.

3. Dry retro-reflectivity. Contracts with 50,000 ft or more of longitudinal paint line or 10,000 ft or more for each type of

longitudinal durable marking line applied shall have retro-reflectivity measured, except black markings and markings placed on seal coat pavements placed in accordance with 404. Longitudinal lines shall meet required minimum initial and retained average retro-reflectivity measurements.

All other contracts and markings, except parking lines, shall meet the required longitudinal line minimum measurements and will be measured by the Department at the discretion of the Engineer, except that quality adjustments will not apply. Retained retro-reflectivity is the value at the time of the warranty expiration in accordance with 808.09 and will be measured by the Department at the discretion of the Engineer.

4. Wet retro-reflectivity. Contracts with longitudinal durable marking line applied shall meet the required longitudinal line minimum measurements for initial wet retro-reflectivity and will be measured by the Department in accordance with ASTM E2177 at the discretion of the Engineer. The testing period will be not less than 14 days to not more than 30 days after the durable longitudinal lines are applied. The initial wet recovery retro-reflectivity for white markings shall exceed 275 mcd/m^2/lx and yellow shall exceed 175 mcd/m^2/lx. Sampling zones that do not meet these wet retro-reflectivity levels for white or yellow markings shall be replaced or receive an additional layer of durable marking material and supplemental elements at no additional cost.

Retro-reflectivity testing equipment shall be furnished, calibrated, and operated in accordance with ITM 931. The markings shall be tested in a period of not less than 14 days to not more than 30 days after the materials are applied. The retro-reflectivity equipment shall remain the property of the Contractor.

The measurement of retro-reflectivity shall be supervised or performed at all times by an operator trained and certified by the unit's manufacturer. A report as described in the ITM and including the specified test results and calculations shall be prepared and provided to the Engineer within three days of each day of testing.

Quality adjustments will be applied to the payment of markings as indicated in the table below. The required minimum initial and retained average retro-reflectivity values for longitudinal line measured in mcd/m^2/lx are as follows:

Material Type	White	Yellow	Quality Adjustment*	Retained White	Retained Yellow
Paint	≥ 250	≥ 175	1.00	n/a	n/a
Required Minimum	150 to 249	125 to 174	0.70		
Thermoplastic	≥ 300	≥ 200	1.00	see 808.09	see 808.09
Required Minimum	250 to 299	150 to 199	0.70		
Multi-Component	≥ 300	≥ 200	1.00	see 808.09	see 808.09
Required Minimum	250 to 299	150 to 199	0.70		
Preformed Plastic	≥ 650	≥ 450	1.00	see 808.09	see 808.09
Required Minimum	550 to 649	350 to 449	0.70		
* Quality Adjustments do not apply to the retained retro-reflectivity values.					

(a) Traffic Paint

1. Application

Traffic paint shall be applied only when the ambient air and pavement temperature is 40ºF or higher and will remain 40ºF or higher for 2 h after application.

The markings shall be protected from traffic until dry to eliminate tracking.

The wet film thickness of the traffic paint shall be a minimum of 15 mils. Painted lines and markings shall be immediately reflectorized by applying beads at a uniform minimum rate of 6 lb/gal. of traffic paint. Only standard or modified standard beads shall be used for paint markings.

2. Equipment

Traffic paint shall be applied with a spray type machine capable of applying the traffic paint under pressure through a nozzle directly onto the pavement. The truck-mounted machine shall be equipped with the following:

a. air blast device for cleaning the pavement ahead of the application,

b. guide pointer to keep the machine on an accurate line,

c. spray guns which can be operated individually or simultaneously,

d. agitator or recirculation system as appropriate,

e. control device to maintain uniform flow and application,

f. capability of heating the material to application temperatures,

g. automatic device which will provide a line of the required pattern,

h. automatic bead dispenser which is synchronized with the marking application.

A hand-propelled machine may be used to apply markings. A brush may be used if approved to apply some markings.

3. Performance Requirements

The color and durability requirements shall be met for a minimum of 90 days after application.

Pavement marking segments which are found to have an average retro-reflectivity reading below the minimum required shall be re-striped with no additional payment. Pavement markings segments which have more than four of 16 individual readings below the minimum required shall be re-striped with no additional payment. The re-striping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments may be re-striped with no additional payment. Following each re-striping, additional retro-reflectivity measurements shall be made with no additional payment. Quality adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-striped pavement markings shall be placed within ±1/4 in. in width and ±2 in. in length of the original placed markings. Re-striping will not be allowed more than two times, after which removal and replacement of the markings will be required.

(b) Durable Pavement Marking Material

Durable pavement marking material consists of thermoplastic, preformed plastic, or multi-component markings.

Durable pavement marking materials used for center lines, lane lines, or edge lines shall be installed within a groove in the pavement unless otherwise shown on the plans.

Durable pavement marking materials used for barrier lines, pavement message, and transverse markings shall be surface applied unless otherwise indicated on the plans.

1. Grooving for Durable Pavement Markings

a. Application

The pavement shall be grooved prior to the placement of longitudinal durable pavement markings, excluding bridge decks and approach slabs. The groove or recess shall be installed in a single pass using dry cut equipment that utilizes diamond cutting

blades and that is approved by the pavement marking manufacturer. If there are no markings on the pavement, a guide line shall be placed using paint without glass beads as a template for the grooving operation. The groove shall be at least 1 in. and no more than 2 in. wider than the pavement marking to be placed.

The Contractor may leave a gap in the grooving for longitudinal lines that delineate the radii of lane usage transitions, driveways, intersections, or adjacent to curb that does not have a curb offset to the marking of at least 12 in.

The depth of the groove shall be in accordance with the manufacturer's recommendations and shall be at minimum 5 mils greater than the thickness of the marking material including exposed glass beads, up to maximum allowable depth of 150 mils. A continuous groove shall not be allowed for broken or dotted lane lines. The groove may extend up to 3 in. at either end of a lane line. Grooves shall be no closer than 2 in. to the edge of a longitudinal joint.

b. Groove Finish and Cleaning

The grooved surface shall be cleaned with vacuuming equipment immediately following the grooving operation. The surface shall be clean and dry prior to pavement marking installation. The finished groove surface shall have a fine corduroy-like appearance with a maximum variation in depth of 10 mils.

2. Thermoplastic

a. Application

Thermoplastic marking shall be applied in molten form by conventional extrusion, by ribbon type extrusion, or spray when the pavement and ambient air temperatures are 50°F and rising. Heat bonded preformed thermoplastic may be used for transverse or message markings. The average final thickness of the thermoplastic marking shall be no less than 90 mils and no more than 125 mils. Immediately following the application of the thermoplastic markings, retro-reflectorization shall be provided by applying pavement marking beads to the surface of the molten material. A first drop of supplemental elements shall be applied in accordance with the manufacturer's recommendations and a second drop of standard, modified standard, or supplemental beads in accordance with the manufacturer's recommendations. Individual passes of markings shall not overlap or be separated by gaps greater than 1/4 in. longitudinally.

b. Equipment

The equipment used for the application of thermoplastic markings shall consist of a kettle for melting the material and an applicator for applying the markings. All of the equipment required for melting and applying the material shall maintain a uniform material temperature within the manufacturer specified limits, without scorching, discoloring or overheating any portion of the material.

A truck-mounted machine shall be equipped with the following: an air blast device for cleaning the pavement ahead of the marking operation; a guide pointer to

keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; agitators; a control device to maintain uniform flow and application; an automatic device which will provide a broken line of the required length; and an automatic bead dispenser which is synchronized with the marking application.

A hand-propelled machine may be used to apply markings.

The equipment for applying heat bonded preformed plastic shall be in accordance with the manufacturer's recommendations. An open flame shall not come into direct contact with the pavement.

c. Performance Requirements

When the initial average retro-reflectivity measurement is below the required minimum the segment of line shall be removed and replaced with no additional payment. Pavement markings segments which have more than four of 16 individual readings below the minimum required shall be removed and replaced with no additional payment.

3. Preformed Plastic

a. Application

The markings shall be applied by technicians certified by the manufacturer. The markings shall be applied when the air temperature is a minimum of 40°F and rising. A primer is required if the ambient air temperature is below 50°F. The pavement surface shall be primed with a binder material in accordance with the manufacturer's recommendations.

b. Performance Requirements

When the initial average retro-reflectivity measurement is below the required minimum the segment of line shall be removed and replaced with no additional payment. Pavement markings segments which have more than four of 16 individual readings below the minimum required shall be removed and replaced with no additional payment.

4. Multi-Component

a. Application

This material shall be applied only when the pavement and ambient air temperatures are 40°F and rising. The wet film thickness of the marking material shall be a minimum of 25 mils. Immediately following the application of the markings, retro-reflectorization shall be provided by applying pavement marking beads to the surface of the wet marking. A first drop of supplemental elements shall be applied in accordance with the manufacturer's recommendations and a second drop of standard, modified standard, or supplemental beads in accordance with the manufacturer's recommendations.

b. Equipment

The machine used to apply the marking material shall precisely meter each component, and produce and maintain the necessary mixing head temperature within the required tolerances. The machine shall be equipped in accordance with 808.07(a)2.

c. Performance Requirements

Pavement marking segments which are found to have an average retro-reflectivity reading below the required minimum shall be re-striped with no additional payment. Pavement markings segments which have more than four of 16 individual readings below the minimum required shall be re-striped with no additional payment. The re-striping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments may be re-striped with no additional payment. Following each re-striping, additional retro-reflectivity measurements shall be made with no additional payment.

Quality adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-striped markings shall be placed within ±1/4 in. in width and ±2.0 in. in length of the original placed markings. Re-striping will not be allowed more than two times, after which removal and replacement of the markings will be required.

808.08 Marking Protection and Maintenance of Traffic

Protection of the traveling public, of the pavement marking crews, and of the pavement markings shall be provided during the marking operation through the use of proper equipment, traffic control devices, safety devices, and proper procedures. Traffic control devices shall be placed in accordance with 107.12. Flaggers shall be provided for traffic control as directed.

(a) Vehicle Signs

Each vehicle in the marking operation shall display the slow moving vehicle emblem when operating at speeds of 25 mph or less. The slow moving emblems shall be removed when the vehicles are operating at speeds greater than 25 mph. The paint crew signs shall be 24 in. high by 96 in. wide, with 12 in. series C black letters on an orange encapsulated lens reflective background. Type A and Type C flashing arrow signs shall be in accordance with 923.04.

(b) Vehicle Warning Lights

All amber flashing warning lights and amber strobe lights mounted on vehicles used in the marking operation shall be in accordance with 801.14(d). All vehicles used in the marking operation shall have a minimum of one flashing amber warning light or amber strobe light which is visible in all directions.

(c) Cones

Cones shall be used to protect marking material which requires more than 60 s drying time. Cones shall remain in place until the marking material is dry or firm enough not to track or deform under traffic. Cones shall be removed as soon as possible

and shall never be left in place overnight. Edge lines shall not require protection with cones.

The maximum spacing of cones shall be as follows:

	40 mph or less	over 40 mph
Broken Lines	every line segment	every fifth line segment
Solid Lines	20 ft to 30 ft	

(d) Front Escort Vehicles

A front escort vehicle shall be used if the marking vehicle extends across the center line while operating. This front escort vehicle shall be equipped with a forward facing paint crew sign, a rear facing slow moving vehicle emblem, and a red flag mounted at least 10 ft above the pavement.

(e) Marking Application Vehicles

Marking application vehicles such as edgeliner or centerliner trucks shall have a rear facing Type A or Type C flashing arrow sign, an amber flashing warning light mounted near the center of the truck bed, and an amber strobe light mounted on each rear corner of the truck bed. The amber flashing warning light and the amber strobe lights shall be mounted on retractable supports and shall be operated at a height of 12 ft above the pavement unless otherwise directed.

(f) Rear Escort Vehicles

If cones are not required, a rear escort vehicle shall follow a marking application vehicle at a distance of 100 to 500 ft. If an additional rear escort vehicle is required due to drying time or heavy traffic volume, it shall follow the first rear escort vehicle at a maximum distance of 1,000 ft, and may operate in the travel lane or on the paved shoulder.

If cones are required, the cone setting truck shall follow the marking application vehicle and shall be followed by a rear escort vehicle. The cone pickup truck shall be followed by another rear escort vehicle.

All rear escort vehicles shall be equipped with a rear facing Type C flashing arrow sign mounted above a rear facing paint crew sign. On two-lane two-way roads, this Type C flashing arrow sign shall be operated with the arrowhead turned off. The supply truck may be used as a rear escort vehicle providing it is empty and is equipped with the required traffic control devices.

808.09 Warranty for Durable Pavement Marking Material

Durable pavement marking material shall be warranted against failure resulting from material defects or method of application, or the result of snowplowing and deicing activities. The material shall be warranted to retain its color, adherence to the pavement, and shall be free of other obvious defects or failures. Grooved durable

pavement markings shall also be warranted to retain retroreflectivity as specified below.

All pavement traffic markings which have failed to meet the warranted conditions shall be replaced with no additional payment.

For the terms of the warranty a unit shall be defined as a 1,000 ft section of line of specified width in any combination or pattern.

(a) Surface Applied Durable Pavement Marking Warranty

The warranty period for surface applied durable markings shall be 180 days beginning with the substantial completion date for the contract as defined in 101.64, but not prior to November 1 of the calendar year in which the last pavement markings were installed. If more than 3% of a unit or 3% of the total of any one intersection or set of transverse markings fails, the failed portion shall be replaced. All pavement markings required to be replaced under the terms of this warranty shall be replaced within 60 days of the notification of failure.

(b) Grooved Durable Pavement Marking Warranty

The warranty period for durable markings placed in a groove shall be two years beginning with the substantial completion date for the contract as defined in 101.64, but not prior to November 1 of the calendar year in which the last pavement markings were installed. The retained retro-reflectivity, mcd/m^2/lx, as determined by ITM 931 shall meet or exceed the minimum values at all times during the warranty period as follows:

Material	Year	White	Yellow
Thermoplastic	1	225	150
	2	175	125
Multi-Component	1	225	150
	2	175	125
Preformed Plastic	1	400	300
	2	300	200

If more than 5% of a unit or 5% of the total fails, the failed portion shall be replaced. All pavement markings required to be replaced under the terms of this warranty shall be replaced within 60 days of the notification of failure.

808.10 Removal of Pavement Markings

Pavement markings which conflict with revised traffic patterns and may confuse motorists shall be removed immediately before, or immediately following, any change in traffic patterns as directed or approved.

Removal of pavement markings shall be to the fullest extent possible without materially damaging the pavement surface. Pavement marking removal methods shall be sandblasting, steel shot blasting, waterblasting, grinding, or other approved

mechanical means. Grooving will not be allowed. Grinding will only be allowed under the following conditions:

(a) when removing durable pavement markings, or

(b) when removing non-durable markings where another course of material is to be placed on the existing course.

Painting over existing pavement markings to obliterate them will not be allowed.

When a blast method is used to remove pavement markings, the residue, including sand, dust and marking material, shall be vacuumed concurrently with the blasting operation or removed by other approved methods. Accumulation of sand, dust or other residual material, which might interfere with drainage or constitute a traffic hazard, will not be allowed.

All damage to the pavement caused by pavement marking removal shall be repaired by approved methods with no additional payment.

808.11 Snowplowable Raised Pavement Markers

Snowplowable raised pavement markers shall be used as supplemental delineation at the locations shown on the plans or as directed.

(a) Surface Preparation

The pavement or bridge deck surface shall be cleaned of dirt, dust, oil, grease, moisture, curing compound, and loose or unsound layers of all materials which would interfere with the proper bonding of the marker to the pavement or bridge deck.

(b) Location

Marker locations shall be accurately laid out and will be subject to approval prior to the installation operation. Markers shall not be located on surfaces that show visible evidence of cracking, checking, spalling or failure of underlying materials. Markers shall not be located within the intersection of a public road. Any marker location, which falls on any of the restricted areas, shall be moved a longitudinal distance not to exceed 10% of the required marker spacing. If this adjusted location still falls within a restricted area, then that marker location shall be deleted. Marker locations shall be as shown on the plans.

(c) Reflector Color

The color combinations of the reflectors shall be as shown on the plans unless otherwise directed. When replacement prismatic reflectors are specified, such reflectors shall not be ordered until the quantity and color combinations have been determined and approved.

(d) Installation

Marker installation shall be in accordance with the manufacturer's

recommendations. The pavement surface temperature and the ambient air temperature shall be at least 50°F. The pavement surface shall be dry at the time of marker installation. The installation slot shall be clean and dry before the adhesive is applied. The slot shall be filled with sufficient adhesive to provide a water tight seal between the marker base and the pavement, and to fill all voids between the marker base and the surfaces of the slot. The marker shall be placed in the slot so that the tips of the snowplow deflecting surfaces are below the pavement surface.

If the pavement surface is newly placed HMA, the pavement shall be allowed to cure for two days prior to installing the markers.

Installation of markers on new concrete pavement or bridge decks or on newly overlaid bridge decks shall not be done until after the pavement or bridge deck is ready to be opened to traffic as specified elsewhere herein.

The number of slots cut in one day shall not exceed the number of markers which will be installed in that day. No slots shall be left open overnight.

(e) Removal of Markers

Markers designated for removal shall be as located on the plans or as otherwise specified or directed. If the pavement surface or bridge deck surface is to be removed, the markers shall be removed prior to any surface removal operation.

The markers shall be removed with a jackhammer or other approved equipment. The area of the pavement or bridge deck disturbed by the marker removal shall not exceed 3 in. in depth or extend more than 3 in. out from any side of the marker base. The marker removal operation shall stop if it is determined that excessive damage is occurring to the pavement, or bridge deck.

The resulting holes shall be filled with the appropriate patching material as described herein or as otherwise directed. Concrete pavement which is to be overlaid as part of the contract and HMA pavement shall be patched with HMA intermediate materials. Concrete pavement which is not to be overlaid as part of the contract and concrete bridge decks shall be patched with concrete patching material from the QPL of Rapid Setting Patch Materials. Overlaid bridge decks and bridge decks which are to be overlaid as part of the contract shall be patched with patching material which is compatible with the deck overlay material. All patching material shall be placed in accordance with the appropriate specifications for the patching material.

Removed markers shall become the property of the Contractor and removed from the jobsite prior to the completion of the work.

(f) Replacement of Prismatic Reflectors

Reflectors designated for replacement shall be as shown on the plans or as otherwise directed. Prior to placement of the new reflector, the castings shall be cleaned of all remaining butyl pad materials. All loose or foreign material shall be

satisfactorily removed by sandblasting, wire brush, or other approved mechanical means. Removed reflectors shall be disposed of properly off the project site.

808.12 Method of Measurement

Broken or dotted lines, placed or removed, will be measured by counting the number of broken or dotted lines placed and multiplying the number of counted lines by the length of the broken or dotted line. Solid lines will be measured as the total distance in linear feet of solid lines placed or removed. The material, type, color, or width of broken, dotted, or solid lines to be removed will not be considered when measuring such lines for payment.

Except as otherwise specified, transverse marking lines will be measured as the total distance in linear feet of lines placed or removed. Transverse marking yield lines will be measured transversely including the entire extent of the marking line and gaps. Curb markings will be measured by the linear feet along the front face of the curb. Grooving for pavement markings will be measured as the total distance of grooving for each pavement marking line in linear feet. Pavement message markings will be measured by the total number of each type placed. A railroad crossing pavement message marking shall include the two R's, the X, and the three stop lines per traffic lane. Railroad crossing pavement message markings will be measured by the total number of each marking place. Lane indication arrow pavement message markings will be measured by the number of lane indication arrowheads placed. Removal of pavement message markings will be measured in square yards using areas shown in the following table. The material will not be considered when measuring such markings for pavement.

PAVEMENT MESSAGE MARKINGS	
Description	**Area**
"Ahead"	3.1 SYS
Combo Arrow	3.1 SYS
"Exit"	2.5 SYS
"Left"	2.5 SYS
"Only"	2.5 SYS
Railroad "R"	0.6 SYS
"Right"	3.2 SYS
"RXR"	7.7 SYS
"School"	3.9 SYS
"Stop"	2.6 SYS
Straight Arrow	1.4 SYS
"Turn"	2.6 SYS
Turn Arrow	1.7 SYS
"XING"	2.5 SYS

Snowplowable raised pavement markers will be measured by the number placed or removed. Prismatic reflectors will be measured by the number furnished and

installed. Each two-way prismatic reflector will be measured as one reflector. No measurement will be made of the adhesive or the hole patching material used in the placement or removal of snowplowable raised pavement markers.

808.13 Basis of Payment

Lines and transverse markings placed will be paid for at the contract unit price per linear foot for the material, type, color, and width specified. Grooving for pavement markings will be paid for at the contract unit price per linear foot. Curb markings will be paid for at the contract unit price per linear foot for curb painting, of the color specified. Pavement message markings placed will be paid for at the contract unit price per each, for the material and message specified. Lines and transverse markings removed will be paid for at the contract unit price per linear foot. Pavement message markings removed will be paid for at the contract unit price per square yard.

Snowplowable raised pavement markers, furnished and installed, or removed will be paid for at the contract unit price per each. Prismatic reflectors will be paid for at the contract unit price per each. Each two-way prismatic reflector will be paid for as one reflector.

Payment for furnishing, calibrating, and operating retro-reflectivity testing equipment will be paid for at the contract price for lump sum. The cost of report preparation shall be included in the cost of retro-reflectivity testing. Adjustments to the contract payment with respect to retro-reflectivity of performance based pavement markings will be included in a quality adjustment in accordance with 109.05.1.

The Engineer may waive retro-reflectivity testing due to weather limitations. Retro-reflectivity testing will be waived for markings applied after October 31 and before April 1. If retro-reflectivity testing is waived, no payment will be made for retro-reflectivity testing. If retro-reflectivity testing is not waived by the Engineer due to weather or waived by the seasonal time restriction and retro-reflectivity testing is not performed, no payment will be made for retro-reflectivity testing and payment for the marking items will be made at 70% of the unit price.

Payment will be made under:

Pay Item	Pay Unit Symbol
Curb Painting, _____ (color)	LFT
Grooving for Pavement Markings	LFT
Line, _____ (material), _____ (type), _____ (color), _____ in. (width)	LFT
Line, Remove	LFT
Pavement Message Marking, _____ (material), _____ (message)	EACH
Pavement Message Marking, Remove	SYS

710 Prismatic Reflector ..... EACH
Retro-Reflectivity Testing ..... LS
Snowplowable Raised Pavement Marker ..... EACH
Snowplowable Raised Pavement Marker, Remove ..... EACH
Transverse Marking, _____, ____, _____, _____ in. ..... LFT
material type color width
Transverse Marking, Remove ..... LFT

No additional payment will be made for the removal and or replacement of markings that fail to meet the performance or warranty conditions of 808.07 and
720 808.09.

The cost of removal of existing prismatic reflectors shall be included in the cost of prismatic reflectors.

Beads, binder material for thermoplastic and preformed plastic, adhesive for snowplowable markers, patching material for snowplowable marker removal, guide lines for grooving operations, pavement cleaning and surface preparation, and all necessary incidentals shall be included in the cost of the pay items.

SECTION 809 – ITS CONTROLLER CABINETS AND FOUNDATIONS

809.01 Description

This work shall consist of furnishing and installing ITS cabinets and foundations in accordance with 105.03.

MATERIALS

809.02 Materials

10 Materials shall be in accordance with the following:

ITS Controller Cabinet 925
Padlock ..... 925.04(aa)

Materials for ITS cabinet foundations shall be in accordance with 805.02.

CONSTRUCTION REQUIREMENTS

809.03 General

20 ITS cabinet foundations shall be installed in accordance with 805.13.

A seal of silicone caulking compound shall be placed between each controller cabinet and the concrete foundation after the cabinet placement.

A rubber duct seal shall be used to seal all conduits that enter the bottom of the cabinet.