

SECTION 762 PAVEMENT MARKING

762.01 DESCRIPTION.

This work consists of furnishing and installing specified pavement markings at the designated locations.

762.02 MATERIALS.

Pavement Marking material shall meet the following:

Item	Section
Pavement Marking Paint*	880.01
Glass Beads for Pavement Marking Paint	880.02
Plastic Pavement Marking Film*	880.03
Preformed Patterned Pavement Marking Film	880.06
Pavement Marking Sheeting	880.07
Short-Term Pavement Marking	
Paint	880.08
Tape	880.08
Raised Pavement Markers	880.10
Pavement Marking	880.11

*Either "slow," "medium," or "fast dry" paint and either type of Plastic Marking Film may be used.

762.03 EQUIPMENT.

Paint Applicator. The equipment required to apply pavement marking paint and glass beads shall be a self-propelled, pneumatic spraying machine with atomizing nozzles capable of applying two 4-inch to 8-inch wide lines at one time. The spray mechanism shall be operated by quick opening and closing valves. The applicator shall apply the materials at a rate specified in an even and uniform thickness with clearly defined edges. The applicator shall have reservoirs or tanks equipped with agitators that keep the material in a smooth, even mixture. Tanks shall have sufficient capacity to apply the materials as specified. The applicator shall be equipped with an automatic skip control device that applies a stripe of specified length with a linear tolerance of 3 inches. The applicator shall be equipped with a guide boom and be capable of retracing and applying materials to traffic markings in place.

Adequate hand-operated equipment shall be required to place the pavement markings on areas not readily accessible to the pavement marking applicator.

The machine shall be equipped with a glass bead dispenser adjusted and synchronized with the paint applicator to distribute the reflectorizing spheres uniformly on the

painted line(s) using air pressure. The bead dispenser shall be equipped with an automatic cutoff control, synchronized with the cutoff of the striping material.

Grooving Equipment. The grooving equipment shall utilize diamond blades mounted on a self propelled machine designed for grinding a recess into the pavement surface. The diamond blades shall be gang mounted on a floating head with controls capable of providing uniform depth and alignment. The grooving equipment shall be capable of grooving a total width sufficient to install 4-inch wide pavement marking tape in a single pass. The equipment shall not cause strain or damage to the underlying surface of the pavement. Grooving equipment that causes ravels, aggregate fractures, spalling, or disturbance of the joints shall not be permitted.

762.04 CONSTRUCTION REQUIREMENTS.

- A. **General.** A project layout of the pavement striping and marking shall be prepared and submitted to the Engineer for approval 48 hours before any installation work. Type F paint shall be used for all painted centerline pavement marking, other than short-term pavement marking.
- B. **Pavement Surface Preparation.**
1. **General.** The pavement surface in the area where markings are to be applied shall be clean and dry. Foreign materials, (i.e., dirt, petroleum products, paint, and curing compound) shall be removed from the pavement surface before applying pavement marking. The amount of pavement moisture shall be tested by taping a 12-inch by 12-inch (approximate) sheet of transparent plastic film, similar to "Saran Wrap," to the pavement. If moisture condenses on the pavement side of the film within 15 minutes, the pavement must be dried before installing pavement markings. The moisture test will not be required when water-based pavement marking paint is used.
 2. **Plastic Pavement Marking Film.** The pavement surface shall be cleaned by sandblasting, power water spray, grinding, wire brushing, brooming, compressed air, or other methods to the satisfaction of the Engineer. New Portland Cement concrete that has curing compound on it shall be sandblasted. Costs associated with the required cleaning shall be an incidental item to payment for the plastic pavement marking film. If short-term or permanent pavement marking is encountered, removal will be paid for at the Contract Unit Price bid for Obliteration of Pavement Marking. When no bid item is provided, the cost of removing the pavement marking will be paid for under Section 104.03 D.
 3. **Preformed Patterned Pavement Marking Film.** The preformed marking shall be capable of being adhered to asphalt concrete by a pre-coated pressure sensitive adhesive. A primer may be used to precondition the pavement surface.
 4. **Pavement Marking Paint.** If the Engineer requires a cleaning method other than air pressure, the cost of cleaning will be paid for under Section 104.03 D.
 5. **Short-Term Pavement Marking.** Short-term pavement marking shall be an application of pavement marking paint, pavement marking tape, or raised

pavement markers. The surface preparation for application of the short-term pavement marking shall be the same as that required for permanent striping.

6. **Grooved Pavement Markings.** When specified in the plans, the pavement surface shall be grooved to make a recess in the pavement surface for the pavement marking film. The groove shall meet the following tolerances:

Depth	40 mils \pm 5 mils
Width	line width plus 1/2 inch
Length	line length plus 3 inches per end of line
Line End Tapers	3 inches

For messages, the area grooved shall be the same area as the messages. Grooving a rectangular area to contain the message will not be allowed. Grooving shall meet the depth requirements specified above.

After grinding, the grooved slot shall be blown clean to remove any residue and loose materials prior to the installation of the pavement marking. When wet-grinding, the grooved slot shall immediately be pressure washed to remove residue. If necessary, the grooved slot shall be blown clean just ahead of the pavement marking installation. The pavement markings shall be installed on a clean dry surface within 24 hours of the initial grinding. If pavement marking installation does not occur within 24 hours of the initial grinding, the groove shall be sandblasted and blown clean to remove any dirt, oil, loose material, or other contaminate prior to the installation of the pavement marking.

The pavement marking film shall be installed as specified in Section 762.04 D.

C. Traffic Control.

1. **Signing.** The Contractor shall erect and maintain sufficient devices (cones, signs, barricades) to protect the work area from traffic interference, tracking on or damage to the cleaned pavement, and the newly applied markings. All devices used to divert traffic from the work zone shall be designed to resist displacement by wind.
2. **Traffic Movement.** Traffic shall be maintained through the work area at all times according to the traffic control plan and Section 704. Flagpersons shall be furnished when required.

PROTECTION VEHICLE WITH TRUCK MOUNTED ATTENUATION DEVICE (TMA):

A protection (shadow) vehicle with a truck mounted attenuation device shall be provided by the contractor to protect personnel and equipment from damage during mobile operations. The protection (shadow) vehicle will not be required on construction projects when the advance warning signs are in place.

Truck-mounted attenuation device shall meet the test requirements of (NCHRP) Report 350 test level TL-3.

The protection vehicle equipped with the TMA shall have a minimum weight of 10,000 pounds or the minimum weight recommended by the manufacturer of the TMA.

The protection vehicle shall be equipped with seat and shoulder belts along with a head cushion.

The protection vehicle shall have an advance warning flashing or sequencing arrow panel conforming to NDDOT Specification 704.02M and the *Manual on Uniform Traffic Control Devices*.

The positioning of the protection vehicle with the TMA in relation to construction activities will be as shown in the plans.

The cost of furnishing the protection vehicle with the TMA shall not be bid separately, but shall be included in the price bid for the item "Pavement Markings."

3. **Time Period for Control.** Necessary traffic control devices shall be properly placed and in operation before construction is allowed to start. The devices shall be kept current and placed only in the areas of actual work activities. Traffic control devices shall be kept in place until the Engineer approves their removal after the pavement marking has dried, and is determined to be ready for traffic.
4. **Operational Precautions.** Equipment shall not be prepared, filled, or cleaned, nor shall any equipment or material be stored on the roadway. These operations shall be conducted off the pavement without interfering with or endangering traffic according to Section 107.05 A.

D. Pavement Marking Application.

1. Pavement Marking Paint and Glass Beads.

- a. **Method of Application.** Pavement marking paint and glass beads shall be applied separately by machine. Where machine application in an odd-shaped area is not feasible, hand application is permitted.
- b. **Application Dates and Temperatures.** Pavement marking paint and beads (except for temporary stripe) shall not be applied before May 1 nor after October 1 except upon written permission of the Engineer. Pavement marking paint shall be applied only during daylight hours when the air and pavement surface temperatures are 40°F. or warmer when applying solvent based paint or 45°F. or warmer when applying water based paint. The paint shall not be applied when the air and pavement surface temperatures are expected or forecasted to be colder (lower) than the minimum application temperature.

New asphalt pavement shall be allowed to cool to a maximum temperature of 125°F. and be given a minimum curing period of four hours prior to applying permanent striping.

- c. **Rate of Application.** One gallon of paint shall cover a 4-inch wide stripe for a length of 280 to 320 feet, depending upon pavement surface texture. The paint shall not be diluted, but a small amount of naphtha thinner may be used to flush out paint containers. Glass beads shall be evenly distributed over the wet paint stripe at a rate of at least 6 pounds

per gallon of paint. Beads shall be applied using an automatic pressure dispenser. If the application rates are not within the requirements, the marking application shall be stopped until corrections are made.

- d. **Short-Term Pavement Marking.** Pavement marking paint and beads applied as short-term pavement marking shall be applied only during daylight hours. Application shall be made in a 4-inch width and a 10-foot length with unpainted gaps of 30 feet. The no-passing zone markings shall be made in a 4-inch width and a length as required to cover the no-passing zones. The paint and beads shall be applied as required and at the rate specified in Section 762.04 D.1.c. Short-term pavement marking applied to the center line shall be applied to the full length of the bituminous course and milled surface before sunset on the same day the work is accomplished. Paving or milling operations shall not resume if the short-term pavement marking has not been replaced as required.

On the final lift, new asphalt pavements shall be allowed to cool to a maximum temperature of 125°F. before applying short-term pavement marking paint.

Short-term pavement marking on the top lift shall be carefully placed with exact alignment and spacing so that the permanent striping will match when applied. Errors in alignment and spacing shall be corrected at the Contractor's expense, or removed just before the installation of the permanent striping.

When Type NR (Not Easily Removable) short-term pavement marking is specified, pavement marking paint and beads may be used in lieu of Type NR construction zone marking film.

- e. **Short-Term Pavement Marking – Seal Coat Projects.** Short-term pavement marking for seal coat projects shall consist of pavement marking paint and beads. Before sealing operations, spotting tabs shall be installed every 200 feet along the centerline and tabs shall also be placed to mark the beginning and end of the no-passing zones. The spotting tabs shall be removed by cutting the tabs flush with the roadway surface. Tabs shall not be pulled out. The cost of the spotting tabs and their installation and removal shall be incidental to the short-term pavement marking bid item.

The short-term pavement marking shall be applied before sunset each day to the full length of the roadway that received the bitumen and cover coat material that day. Seal coat operations shall not resume if the short-term pavement marking is not in place as required. The broken line at centerline of 2-lane, 2-way roadways (yellow) or between lanes of multi-laned roadways (white) shall be 4 inches wide and 10 feet long followed by a 30-foot unpainted gap. The solid line barrier stripe (yellow) in no-passing zones shall be 4 inches wide, and the length shall be that required to cover the entire no-passing zone. Before applying the paint and beads, the areas to receive the striping shall be lightly broomed.

If the in-place short-term pavement marking has become obscured and has lost its required visibility due to being covered, or partially covered,

by cover coat or blotter material, the material shall be removed from the striped areas by light brooming or compressed air before sunset. Damage to the cover coat material and striping resulting from the removal operation shall be corrected at the Contractor's expense.

The short-term pavement marking shall be carefully placed with exact alignment and spacing so that the permanent striping matches when applied. Errors in alignment and spacing shall be corrected at the Contractor's expense.

One gallon of paint shall cover a 4-inch wide stripe for a length of 200 to 240 feet, as directed by the Engineer. Glass beads shall be evenly distributed over the wet paint at the rate of at least 6 pounds per gallon of paint.

f. **Tolerances.**

- (1) The length of the painted stripe shall not vary more than plus or minus 3 inches from the prescribed length.
- (2) The width of the painted stripe shall not vary more than plus or minus 1/2 inch from the prescribed width.
- (3) The length of the painted segment and gap shall not vary more than 6 inches in a 40-foot cycle.
- (4) The tolerance from the proper alignment shall not vary more than plus or minus 2 inches.
- (5) Dashed lines that are painted over existing dashed lines shall begin within 6 inches of the beginning of the existing line, unless otherwise directed by the Engineer.

2. **Plastic Pavement Marking Film.**

- a. **General.** Plastic pavement marking film applied as a permanent pavement marking shall not be applied before June 1 nor after September 1 of any year. The permanent marking film shall not be applied when the pavement surface temperature is 50°F. or colder, nor shall the film be placed over painted markings. The pavement surface and the marking film shall be prepared for installation as required for the type of film used. The film shall be lap or butt spliced when required to join 2 lengths of film, and the film shall be cut at open joints or cracks in the pavement. The cut ends shall be firmly tamped in place.
- b. **Plastic Pavement Marking Film Application.** Application of plastic pavement marking film, whether by contact cement or mechanical application, shall be made using the manufacturer's recommendation.
- c. **Short-Term Pavement Marking.** Pavement marking tape applied as short-term pavement marking shall conform with the requirement for application of pavement marking tape. The tape shall be applied on the center line in a 4-inch width and a 10-foot length with a gap of 30 feet. The no-passing zone markings shall be made in a 4-inch width and a

length as required to cover the no-passing zone. The short-term pavement marking shall be applied to the full length of the bituminous pavement and milled surface placed each day, and shall be completed before sunset each day. Paving and milling operations shall not resume if the striping is not in place as required.

Type R (Removable) or Type NR (Not Easily Removable) construction zone marking film shall be applied where specified. The film required shall be applied as specified for pavement marking film.

The Contractor shall remove the Type R marking film when required in the Contract or directed by the Engineer.

Pavement marking paint with beads may be used in lieu of Type NR construction zone marking film for short-term pavement marking.

3. **Preformed Patterned Pavement Marking Film.** Application of preformed patterned pavement marking film shall be according to the manufacturer's recommendation.
4. **Pavement Marking Sheeting (Pressure Sensitive).** This marking shall be applied as required in the Contract or by hand or mechanical methods to a pavement surface prepared as required for all pavement marking. The delineated position on the pavement surface shall be primed using the sheeting manufacturer's recommendations. The primed surface shall be air dried for one to 2 minutes before applying the sheeting. Mechanical application conforming to the sheeting manufacturer's recommendations shall be used, unless machine application is impractical. Sheeting shall be inlaid into the pavement by roller when the pavement is warm enough to accept the pavement marking sheeting without damaging the sheeting.
5. **Raised Pavement Markers.** Raised pavement markers shall be reflectorized. Broken lane lines and center lines on 2 lane 2-way roadways shall consist of 4 markers on 3.33 foot centers with a 30-foot gap. Markers used for solid lines shall be spaced on 5 foot centers. Raised pavement markers used in double solid lines shall be placed side by side separated by a 4-inch gap.

New concrete pavement (pavement that has had no traffic over it for a winter season) shall have markers placed on 5-foot centers for all solid lines.

6. **Epoxy Paint and Glass Beads.**
 - a. **Description.** The work shall consist of furnishing and installing reflectorized white and yellow two-component, 100% solids epoxy pavement markings. Applications are lines, legends, symbols, crosswalks and stop lines placed on properly prepared asphaltic and portland cement concrete pavement surfaces in accordance with the Plans, Specifications, and as directed by the Engineer. Upon curing, the materials produce pavement markings of specified thickness, width and retroreflectivity that resist wear from high traffic volumes for several years. During darkness and weather permitting, yellow markings shall be readily distinguishable from white markings.
 - b. **General.** Pavement markings shall be placed in accordance with the details shown in the Plans and the control points established by the Engineer.

The road surface shall be cleaned at the direction of the Engineer just prior to an application. Pavement cleaning shall consist of at least brushing with a rotary broom (non-metallic), or as recommended by the material manufacturer and acceptable to the Engineer. New portland cement concrete surfaces shall be cleaned by sandblasting or shotblasting to remove any surface treatments and/or laitance. On low speed [Speed Limit 40 mph or less] urban portland cement concrete roadways, sandblast or shotblast cleaning shall be used for all epoxy pavement markings.

If the roadway surface is dry, the epoxy material application shall immediately follow the pavement cleaning and be preceded by an air blast. However, markings shall not be applied when the wind or other conditions cause a film of dust to be deposited on the pavement surface before the material can be applied.

The Engineer will place necessary spotting at appropriate points as overall horizontal control for striping and to indicate necessary starting and cutoff points. Broken line intervals will not be marked. Longitudinal joints, pavement edges, and existing markings shall serve as control points when so directed.

The epoxy pavement marking material will be applied at a thickness of 25 mils on new concrete surfaces and 20 mils on new asphalt surfaces (calculated without drop on glass beads). The minimum line width shall be its nominal width with 1/4 inch greater than the nominal width allowed provided the variation is gradual and does not detract from the general appearance. Broken line segments, normally 10 feet every 40 feet., may vary up to 3 inches from the specified lengths provided the over and under variations are reasonably compensatory. Alignment deviations from the control guide shall not exceed 2 inches, except when approved by the Engineer. Material shall not be applied over a longitudinal joint. Establishment of application tolerances shall not relieve the Contractor of his responsibility to comply as closely as practicable with the planned dimensions.

- c. **Spraying Operation.** Placement of epoxy materials shall be permitted only on a clean, dry pavement surface and air and pavement temperatures at least 50°F unless the manufacturer, in writing, approves a lower temperature.

Two parts of epoxy component A (pigment) and one part component B (hardener) shall be heated separately at $110 \pm 1^\circ\text{F}$ and thoroughly mixed. All material heated over 140°F shall be discarded. The sprayed epoxy shall be applied at $110 \pm 1^\circ\text{F}$ or as recommended by the manufacturer.

Glass beads shall be applied immediately after the placement of the epoxy. The dispenser system must deliver at least 25 pounds of beads per gallon of epoxy material. The Contractor shall cooperate with inspection personnel in reviewing operation of the equipment, safety precautions, measurement of materials (components and beads), computations to determine epoxy thickness, and notifications as to work schedule.

Type II epoxy material shall be used for epoxy pavement markings except when Type I is specified on the plans.

Traffic control for the pavement marking operations shall be in substantial conformance with the MUTCD. A shadow vehicle with a truck-mounted attenuator shall be used on high speed [SPEED LIMIT (40 mph) and greater], high volume (ADT 1500 and greater) highways.

E. Inspection and Acceptance.

1. **General.** Markings that are discolored, damaged by wind-blown dirt, or are ineffective at night will be rejected. Unsightly markings with uneven edge lines, poor longitudinal alignment, uneven adherence, missing portions, or other objectionable faults will be rejected. All rejected markings shall be repaired, or removed and replaced at the Contractor's expense.
2. **Maintenance of Short-Term Pavement Markings.** Short-Term Pavement Markings used on the Project will be rated according to the American Traffic Safety Services Association's (ATSSA) *Quality Standards for Work Zone Traffic Control Devices*. The definition of "acceptable", "marginal", and "unacceptable" and the evaluation guidelines shall be as defined in ATSSA's *Quality Standards for Work Zone Traffic Control Devices*.

At the time of initial set up and major phase changes, 100% of each type of short-term pavement marking (painted, tape, raised marker) shall be classified as acceptable. The contractor shall certify in writing to the Engineer that all short-term pavement markings installed are classified as acceptable.

The amount of acceptable markings of each type may decrease to the limits defined in the ATSSA standards as a result of damage or deterioration during the course of work. Pavement markings evaluated as unacceptable shall be replaced within 12 hours.

Raised Pavement Markers shall be cleaned as necessary to remove dirt, mud, or other foreign material which reduces the brightness of the reflectorized sheeting.

All markings no longer required shall be removed immediately.

3. **Pay Adjustment for Short-Term Pavement Markings.** If the Project is not completed and extends into winter suspension, the Engineer will inspect the markings before suspending the Contract; and any unacceptable markings shall be repaired before the Contractor is relieved of further liability.

If the Contract must be carried through the winter due to Contractor-caused delays, markings shall be maintained throughout winter suspension by and at the Contractor's expense.

During the maintenance period, markings which are not functioning properly shall be replaced by and at the Contractor's expense. Failure to make these repairs will result in a reduced pay factor for the markings according to the following schedule:

% of Ineffective Striping**Pay Factor**

10-20%/mile, and not more than 200 L. Ft. of markings missing in one continuous stretch

50% of Bid Price for that mile

Over 20%/mile, or more than 200 L. Ft. of markings missing in one continuous stretch

No payment for that mile

No deduction will be made for markings lost due to abrasion at approaches or due to snow removal equipment.

All markings no longer required shall be removed immediately.

4. **Acceptance of Epoxy Paint Pavement Marking.**

In order to be a long-life pavement marking, epoxy markings placed in North Dakota must retain a satisfactory level of retroreflectivity in addition to demonstrating good adhesion, resisting chipping, and exhibiting proper daytime and nighttime colors.

a. **Retroreflectivity.**

(1) Acceptable Minimum Retroreflectivity Values.

**MINIMUM AVERAGE RETROREFLECTIVITY VALUES
FOR EPOXY MARKING
(mcd/m²/lux)**

Period	White	Yellow
Initial*	275	180
After-One-Winter*	200	150

*Described under Miscellaneous Controls, numbers 4 and 5.

(2) **Retroreflectometers.** Measurements shall be taken with either a portable or mobile retroreflectometer conforming to 30-meter geometry which is defined as: the entrance angle (the angle between the illumination axis and the retroreflector axis) shall fall between 88.50° and 88.76° and the observation angle (the angle between the illumination axis and the observation axis) shall fall between 1.0° and 1.05°; and, the co-viewing angle (the complement of the entrance angle) shall fall between 2.29° and 2.50°. All retroreflectivity readings and data analysis will be provided by NDDOT at no cost to the Contractor. NDDOT reserves the right to:

- make daytime and/or nighttime visual inspection with or without the presence of the Contractor's representative, mainly to locate obvious or suspect areas of deficiency, and
- determine retroreflectivity of symbols, legends and lines wider than 200 mm (8 inches) using the portable retroreflectometer only.

- (3) **Test Segments.** The following methodology will be used to evaluate retroreflectivity performance of in-service longitudinal line pavement markings:

(a) Portable Retroreflectometer

- 1) The roadway¹ shall be divided into consecutive test segments². A test segment is defined as 2 miles in length. A test segment shall have one test location per line type.³
- 2) For each type of solid line, the number of readings per test location are as follows:

Roadway 0–15 miles in length: 5 reading per test location
Roadway >15 miles in length: 3 readings per test location
- 3) For solid lines, take readings 5 feet apart.
- 4) For broken lines (skip lines), test 2 lines per test location. Take 2 readings from each line. Take readings 30 inches from each end of the line.
- 5) For 10% of each message type, take 5 readings on each message line; for 10% of each symbol type, take 5 readings on each symbol.
- 6) Upon completion of the evaluation, regardless of the results, additional test segments may be ordered by the Engineer.

¹ **Roadway:** As used here, means that portion of a street or highway ordinarily used for vehicular traffic. In the event a street or highway includes two or more separate roadways, the term roadway shall refer to each roadway separately.

² **Test Segments:** Areas of a roadway chosen for measuring retroreflectivity of the line types.

³ **Line Type:** Longitudinal lines of the same color and function. For example, white and yellow edge lines are each a line type.

(b) Mobile Retroreflectometer

- 1) Calibration of the instruments shall be in accordance with the manufacturer's instructions.
- 2) Retroreflectivity shall be measured at a minimum rate of 20 percent of each test segment by line type.
- 3) Should another mobile unit be available, the maximum acceptable deviation for measurements made by the two different instruments of the same manufacturer and for the same roadway length shall be $\pm 10\%$.
- 4) Repeatability for the given mobile unit shall be $\pm 6\%$.
- 5) Upon completion of the evaluation, regardless of the results, additional test segments may be ordered by the Engineer.

(c) Miscellaneous Controls

- 1) Take measurements on a clean, dry roadway.
- 2) Collect data in direction of traffic flow.
- 3) Measurement units are: mcd/m²/lux.
- 4) Wait at least two weeks from date of placement of the markings before taking initial readings.
- 5) Take after-one-winter readings in May or June to assure that spring rains have cleaned the beads.
- 6) Randomly select test locations within a segment unless night reviews or other knowledge supersedes a random selection process.
- 7) Measure each line type separately.
- 8) The Engineer may request additional readings or test segments.
- 9) In the event LASERLUX is not available, the Engineer may require the use of the portable retroreflectometer or establish an alternative evaluation plan.

(5) Contents of Retroreflectivity Report.

(a) The report shall consist of:

- 1) State Project number.
- 2) Trunk Highway number.
- 3) Test date.
- 4) Geographical location of the readings, including distance from the nearest permanent site identification, such as a reference point.
- 5) Identification of the pavement marking material tested: type, color, age, and transverse location on the road.
- 6) Identification of the retroreflectometer.
- 7) Remarks concerning the overall condition of the line, messages and symbols such as carryover of asphalt, snow plow damage, uneven distribution of beads, etc.
- 8) Average of the readings for each test segment with one standard deviation calculated.
- 9) Average of the readings for each message and symbol type.

b. Correction of Defects/Penalties.

- (1) All pavement markings not conforming to the requirements of the Contract shall be removed and replaced or otherwise repaired to the satisfaction of the Engineer. Removal of unacceptable work shall be accomplished with suitable blasting or grinding equipment unless other means are authorized by the Engineer.
- (2) Where yield computations show a deficiency in material usage of not more than 20 percent, NDDOT may require satisfactory repair or may accept the work at a reduced unit price which is in direct proportion to the percent of the deficiency. Where the deficiency in material usage exceeds 20 percent, NDDOT may require removal and replacement to the satisfaction of the Engineer unless other means are approved by the Engineer.
- (3) If the Engineer requires removal and replacement, the contractor shall remove (by an approved process) at least 90% of the deficient line, with no excessive scarring of the existing pavement. The removal width shall be one inch wider all around the nominal width of the pavement marking to be removed.
- (4) Where retroreflectivity falls below the minimum acceptable levels but not more than 20%, the Engineer may require satisfactory repair or may accept the work at a reduced unit price which is in direct proportion to the percent of the deficiency. Where the deficiency in retroreflectivity exceeds 20%, i.e., less than 220 mcd/m²/lux for white and 145 mcd/m²/lux for yellow, the Engineer may require the removal and replacement to the satisfaction of the Engineer unless other means are approved by the Engineer. Where minimum levels after one winter fall below the specified levels (160 mph/m²/lux – 120 mph/m²/lux), NDDOT will notify the project contractor and manufacturer(s) of the failure. If the initial readings were above NDDOT's specified initial minimum levels (275 mph/m²/lux – 180 mph/m²/lux), the Engineer, contractor, and manufacturer(s) of the material(s) shall review the project together. Based on the review of all known aspects, the Engineer will make a determination as to why the job failed and notify the Contractor. If retroreflective fails after the first winter the Engineer may access a deduct as specified above or require removal and replacement.
- (5) If this process has to be repeated on several projects with either the same contractor and/or manufacturer(s), NDDOT will take corrective action. This corrective action will be a two step process:
 - Step 1: Pavement marking contractor/manufacturer(s) will be considered not approved for NDDOT projects, except to bring workmanship/product back into compliance.
 - Step 2: If the first step cannot be attained, pavement marking contractor/manufacturer(s) will not be allowed to participate in NDDOT projects.

762.05 METHOD OF MEASUREMENT.

- A. **Pavement Marking-Painted Line.** This item will be measured by the Linear Foot of the various widths of painted line, complete, in place, and accepted. Only the painted portion of broken lines will be measured. Pavement Marking-Painted Messages will be measured by the square footage shown on the Plans, in place, and accepted by the Engineer.
- B. **Plastic Pavement Marking Film, Pavement Marking Sheeting, and Preformed Patterned Pavement Marking Film.** This item will be measured by the Linear Foot of the various widths of installed line, complete, in place, and accepted. Only the installed portion of broken lines will be measured. Messages will be measured by the square footage shown on the Plans, in place, and accepted by the Engineer.
- C. **Short-Term Pavement Markings.**
1. **Short Term – ___-Inch Line (Painted, Tape, or Raised Markers).** This item will be measured by the linear foot in place. The longitudinal gaps will not be measured. If raised pavement markers are used, the length of measurement will be the length of a pavement line that would exist if paint had been installed.
 2. **Short Term – ___-Inch Line, Type R.** This item will be measured by the linear foot in place.
 3. **Short Term – ___-Inch Line, Type KNURL.** This item will be measured by the linear foot in place.
 4. **Short Term – Message, Type R.** This item will be the square footage as shown on the Plans in place.
 5. **Short Term – Message, Type KNURL.** This item will be the square footage as shown on the Plans in place.
- D. **Raised Pavement Markers.** This item will be measured by the individual unit (Each) complete and in place.
- E. **Obliteration of Pavement Marking.** This item will be measured by the square foot of pavement marking removed.
- F. **Grooved Pavement Markings.**
1. **Preformed Patterned Pavement Marking – __ inch line (Grooved).** Preformed Patterned Pavement Marking – __ inch line (Grooved) will be measured by the linear foot of the various widths of line installed and accepted by the Engineer.
 2. **Preformed Patterned Pavement Marking – Message (Grooved).** Preformed Patterned Pavement Marking—Message (Grooved) will be measured by the square footage of pavement marking message installed and accepted by the Engineer.

- G. **Epoxy Paint Pavement Marking.** This item will be measured by the Linear Foot of the various widths of installed line, complete, in place, and accepted. Only marked portions of broken lines will be measured. Epoxy Paint Pavement Marking – Messages will be measured by the square footage shown on the plans, in place, and accepted by the Engineer.

762.06 BASIS OF PAYMENT.

Payment will be made under:

Pay Item	Pay Unit
Pavement Marking Painted - ___ inch line	Linear Foot
Pavement Marking Painted – Message	Square Foot
Plastic Pavement Marking Film - ___ inch line	Linear Foot
Plastic Pavement Marking Film – Message	Square Foot
Preformed Patterned Pavement Marking - ___ inch line	Linear Foot
Preformed Patterned Pavement Marking – Message	Square Foot
Pavement Marking Sheeting - ___ inch line	Linear Foot
Pavement Marking Sheeting – Message	Square Foot
Short Term – ___-Inch Line (Painted, Tape, or Raised Markers)	Linear Foot
Short Term – ___-Inch Line, Type R	Linear Foot
Short Term – ___-Inch Line, Type KNURL	Linear Foot
Short Term – Message, Type R	Square Foot
Short Term – Message, Type NR	Square Foot
Short Term – Painted Line (Seal Jobs)	Linear Foot
Raised Pavement Markers	Each
Obliteration of Pavement Marking	Square Foot
Preformed Patterned Pavmt. Marking – ___ inch line (Grooved)	Linear Foot
Preformed Patterned Pavmt. Marking – Message (Grooved)	Square Foot
Preformed Plastic – ___-Inch Line	Linear Foot
Epoxy Paint Pavement Markings – ___ inch line	Linear Foot
Epoxy Paint Pavement Marking – Message	Square Foot

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

The price bid for Type R marking film shall include the cost of installation and removal.

SECTION 764 GUARDRAIL

764.01 DESCRIPTION.

This work consists of installing, removing, and resetting guardrail and box beam median barrier.