6.01 Slope Protection

6.01.01 Description

This work shall consist of all necessary excavation and disposal of excavated material, and of constructing, to the lines shown on the plans, a protective covering of the type shown on the plans on a prepared foundation, including headers along the edges of the slope protection, when specified.

6.01.02 Materials

The materials shall meet the requirements specified in MDOT Standard Specifications in the Section designated as follows:

Concrete 35S	7.01
Mortar Type III	7.02
Cement	8.01
Granular Material Class II	8.02
Steel Reinforcement	8.05
Stone for Riprap	8.19
Stone for Heavy Riprap	8.19

6.01.03 Plain Riprap

The bank on which the plain riprap is to be placed shall be trimmed to a uniform slope as shown on the plans. The riprap shall begin in a trench below the toe of the slope and placed on a layer of woven geotextile fabric (ADS 200WTK, MIRAFI 500X or approved equal), as shown on the plans or directed by the Engineer, and shall progress upward, each stone placed by hand and firmly bedded into the slope and against the adjoining stones. The stones shall be laid perpendicular to the slope with the surfaces in contact and with well broken joints. The finished surface of the riprap shall present an even, tight surface. The thickness of the riprap shall be not less than 6 inches, measured perpendicular to the slope. Machine placing will be allowed for plain riprap placed below water.

6.01.04 Heavy Riprap

Heavy riprap shall be constructed in accordance with the requirements of plain riprap except that the thickness of the riprap shall not be less than 12 inches measured perpendicular to the slope. Machine placing will be allowed for heavy riprap.

6.01.05 Method of Measurement

Plain or heavy riprap will be measured in place by area in square yards.

6.01.06 Basis of Payment

The completed work as measured for Slope Protection will be paid for at the contract unit price bid per square yard.

6.09 CONCRETE CURB AND GUTTER

6.09.01 Description

This work shall consist of constructing curb or combination curb and gutter of air entrained concrete with or without steel reinforcement as provided, on the prepared subgrade.

6.09.02 Materials

Concrete shall meet the requirements for 35P or 35S concrete as specified in Section 7.01 "Portland Cement Concrete."

6.09.03 Joints

Joint filler shall be "Flexcell" or equal premolded nonextruding concrete expansion joint material, cut to the shape of the cross-section of the curb or curb and gutter. Expansion joints shall be placed at not more than 300 foot intervals between intersections. All joints shall be one inch thick unless otherwise specified.

When sidewalks or concrete driveway slabs are built adjoining the curb, 1/2 inch expansion joint material shall be placed between the curb and the sidewalk or concrete driveway slabs.

6.09.04 Castings

Where catch basin or inlet castings come in the curb or curb and gutter, the castings shall be set to proper line and grade. (See detailed drawing on the plan detail sheet). Regrading of catch basins and inlets shall be included in the cost of constructing curb or curb and gutter, except where noted on the plans.

6.09.05 Forms

Forms shall be pre-manufactured steel (or other as approved by the Engineer) of sufficient strength to resist the pressure of the concrete. When forming returns or curved sections, flexible strips may be used. The forms shall be held with suitable clamps and stakes to prevent movements or bulging when the concrete is being placed.

6.09.06 Division Plates

Division plates for curb or for combined curb and gutter shall be of steel 1/8 inch in thickness. They shall be of the correct shape and cross-section of the curb and gutter except that they shall not extend closer than three inches to the base of the curb and gutter. Division plates shall be spaced every 10 feet.

6.09.07 Sub-Grade

Subgrade shall be compacted to a firm surface with a uniform bearing power, and shall be thoroughly wet down so as to be in a moist condition immediately before the concrete is placed.

6.09 CONCRETE CURB AND GUTTER (cont'd)

6.09.08 Finishing

Immediately after placing the concrete in the forms, it shall be tamped and spaded sufficiently to bring the mortar to the surface so that no honeycomb will be found when the forms are removed. The concrete shall then be struck off true to the cross-section after which it shall be finished smooth and even by means of a wooden float. Face forms, if used, shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb. The exposed surfaces shall then be finished smooth and even by means of a moist wooden float or a moist wet brick. The remaining forms shall not be removed for at least 24 hours after the concrete has been placed. The edges shall be rounded with an edging tool. No tool marks are to be left on exposed edges. Before final finishing, gutters shall be tested with a 10 foot straight edge to see that the finished gradient is uniform. Any depressions which will not drain shall be corrected. In no place shall plastering of curb and gutter faces be permitted.

6.09.09 Curing

Apply curing compound immediately after free water has evaporated from the surface. Use white membrane curing compound conforming to ASTM C 309, Type 2. The application rate of the curing compound shall not be less than 1 gallon per 180 square feet. In cold weather the curb and gutter shall be protected from freezing during the curing period. Curing and protection of the concrete shall start as soon as possible and continue the required length of time of three days.

6.09.10 Steel Reinforcement

Curb and gutter shall contain two (2) #4 steel reinforcing bars as shown on the standard details and shall be properly spaced and held in the correct position during the placing of the concrete. Three (3) #4 steel reinforcing bars shall be used 8' on either side of all catch basins as shown on the standard details. The steel reinforcing bars shall be epoxy coated.

6.09.11 Method of Measurement

Concrete curb or curb and gutter will be measured in place by length in lineal feet along the base of the curb or along the flow line of the gutter with no deductions in length for catch basin or inlet castings.

6.09.12 Basis of Payment

Concrete curb or curb and gutter will be paid for at the contract unit price per lineal foot, which price will be payment in full for furnishing the materials including steel reinforcement, setting catch basin and inlet castings to line and grade and performing all the work incidental to completing the curb or curb and gutter construction.

6.11 CONCRETE SIDEWALK, SIDEWALK RAMPS, AND DRIVEWAYS

6.11.01 Description

This work shall consist of constructing concrete sidewalks or sidewalk ramps of a width as specified and a depth of four inches or concrete driveways of a width as specified and a depth of five inches where called for on the plans or as directed according to the following specifications.

6.11.02 Materials

Concrete shall meet all requirements for 35P or 35S concrete as specified in Section 7.01, "Portland Cement Concrete."

6.11.03 Construction Methods

(a.) Preparation of Sub-Grade

The subgrade shall be formed by trenching or filling to the required elevation for bottom of concrete or to bottom of subbase, if a subbase is specified. The subgrade shall be thoroughly tamped or otherwise compacted to insure stability. In cuts, the subgrade shall be made sufficiently wide to permit the proper placing of forms, and in fills, the subgrade shall be made at least one foot wider on each side than the required width of the sidewalk. Where required, subbase shall be constructed as specified under Subbase, 2.11. Unless otherwise specified, all fills shall be made of sand, properly compacted.

(b.) Forms

The forms shall be of wood or metal, straight and free from warp, and of sufficient strength to resist springing during the process of depositing concrete against them. The forms shall be the full depth of the concrete.

(c.) Concrete Driveways

Driveways shall be excavated between the curb and the sidewalk to the required width approved by the Engineer and to a depth of 5 inches below a line extended from the walk to the driveway entrance. One-half inch expansion joints shall be provided along the back of the curb and front of the sidewalk prior to placing the concrete. The side of the driveway at the curb shall be rounded up and finished off so as to have the appearance of a rolled curb. The remainder of the driveway shall be troweled to a true line and grade.

(d.) Placing and Finishing Concrete

The subgrade shall be thoroughly wetted, and the concrete shall be placed thereon to the proper depth. The concrete shall be thoroughly spaded along the faces of the forms and adjacent to joints before finishing operations are started. The concrete shall be alternately tamped and struck off with a strike board until all voids are removed and the surface has the required grade and cross-section. The surface shall be floated with a steel float just enough to produce a smooth surface free from irregularities. All edges and joints shall be rounded to a radius of 1/4 inch with an approved finishing tool. The surface shall then be brushed to slightly roughen the surface and remove the finishing tool marks.

6.11 CONCRETE SIDEWALK, SIDEWALK RAMPS, AND DRIVEWAYS (cont'd)

6.11.03 Construction Methods (cont'd)

(e.) Expansion Joints

Three-quarter inch transverse expansion joints shall be placed through the sidewalk at uniform intervals of not more than 60 feet.

One-half inch expansion joints shall be placed between the sidewalk or driveway approaches and the back of curb and gutter or the edge of the pavement.

One-half inch expansion joints shall be placed between the sidewalk and back of abutting parallel curb and gutter, and between the sidewalk and buildings or other rigid structures.

Expansion joint filler shall extend to the full depth of the sidewalk and the top shall be flush with the finished surface of the sidewalk.

The concrete on both sides of the expansion joint filler shall be edged and finished smooth and true to line.

Joint filler shall be "Flexcell: or equal pre-molded non-extruding concrete expansion joint material cut to the shape of the cross-section of the walk.

(f.) Contraction Joints

Contraction joints shall be spaced a distance apart which is equal to the width of the walk. Contraction joints shall be place in the center of drive approaches wider than 12 feet from the sidewalk to back of curb and parallel to the curb where the approach is over 20 feet long. Contraction joints shall be produced by cutting joints in the concrete, after floating, to a depth of not less than 1/8 inch, nor more than 1/4 inch in width, and shall be finished smooth and true to line.

(g.) Reinforcement

Drive approaches and the adjoining sidewalk across the drive approach shall be reinforced with steel 6"x6" 10 Gauge woven wire mesh as shown in the standard details.

(h.) Curing

Apply curing compound immediately after free water has evaporated from the surface. Use white membrane curing compound conforming to ASTM C 309, Type 2. The Application rate of the curing compound shall not be less than 1 gallon per 180 square feet. In cold weather the curb and gutter shall be protected from freezing during the curing period. Curing and protection of the concrete shall start as soon as possible and continue the required length of time of three days.

6.11 CONCRETE SIDEWALK, SIDEWALK RAMPS, AND DRIVEWAYS (cont'd)

6.11.04 Method of Measurement

Concrete Sidewalks, Ramps and Driveways of the thickness specified, will be measured in place, by area in square feet.

6.11.05 Basis of Payment

Concrete Sidewalk, Ramps and Driveways of the thickness specified will be paid for at the contract unit price per square foot, which price shall be payment in full for furnishing the materials, preparing the grade, placing fill and top soil where required, constructing the sidewalk or driveway complete, and cleaning up the premises. Unless otherwise noted in these specifications, removal of existing concrete sidewalk or driveways shall be considered as incidental and no separate payment will be allowed.

6.13 CONCRETE PAVEMENT JOINT AND CRACK SEALING

6.13.01 Description

This work shall consist of sealing cracks and joints in existing concrete slabs.

6.13.02 Materials

The joint filler material shall be a hot-poured rubber-asphalt type joint sealing compound conforming to Federal Specifications as follows:

For Local Streets	Type SS-S-164
For Major Streets	Type SS-S-1401

The compound shall be packed in substantial commercial containers of a size which can be conveniently handled on the job so that the covering may be readily removed from the material without waste. Containers shall be legibly marked with the description, manufacturer's name and brand, weight, safe heating temperature and batch number. The batch number shall be a specific designation to represent the compound manufactured from one batch of raw material, irrespective of the number of mixers involved in the production of the batch. Upon delivery of the joint sealant material to the job, the material shall be properly identified and certified that it has been inspected and tested in accordance with the requirements of the Federal Specification (Method for Sampling and Testing) SS-R-406, Method 223.11. The Contractor shall supply the Owner with certification tickets from the material supplier to verify the above requirements.

6.13.03 Construction Methods

For existing joints, any filler shall be stripped out to a minimum depth of 1 inch. The walls of the joint shall be cleaned by routing.

For pavement cracks, the crack shall be routed out to a sufficient width to allow proper penetration of the sealing compound.

Following the routing operation, for both joints and cracks, all debris shall be removed from the cracks and joints and from the pavement before proceeding to the next step.

Prior to the application of the joint filler, all cracks and joints shall be sandblasted to remove any remaining deleterious material, and following sandblasting shall be thoroughly cleaned by means of an air jet operating at a minimum of 90 psi.

Following cleaning, the joints and cracks shall be inspected and approved by the Engineer prior to filling.

The "hot-pour" joint filler shall be applied in strict conformance with the manufacturer's recommendations.

The filler shall completely fill the crack or joint, except in the case where the opening runs to the subgrade and it shall be allowable to caulk with jute or oakum to within 1" of the pavement surface.

6.13 CONCRETE PAVEMENT JOINT AND CRACK SEALING (cont'd)

6.13.03 Construction Methods (cont'd)

The joint filler shall not be applied to moist surfaces or when the air temperature is less than 50°F.

The filled joint shall be protected from traffic until the material is set sufficiently to resist pickup.

The work shall not be considered complete until the Contractor has cleaned up the work area and removed all debris attributable to his operation.

6.13.04 Method of Measurement

Crack filling will be measured in place in lineal feet for joints and cracks properly sealed with joint filler.

6.13.05 Basis of Payment

Crack filling shall be paid for at the contract unit price per lineal foot, which price shall be payment in full for furnishing all materials, equipment, labor and supervision necessary to remove existing seals, fillers or other foreign material from joints or cracks, for routing joints and cracks and for the application of sealant to the prepared areas.

6.21 SODDING

6.21.01 Description

This work shall consist of furnishing and placing approved live sod on an earth bed of suitable soil and shall include preparation of the earth bed and disposal of surplus materials.

6.21.02 Materials

Sod to be placed on sand soils shall be taken from a sandy loam soil. The sod shall be of such a character and moisture content that it will not break or crumble during the operations of cutting, transporting, or laying. The sod shall be approved by the Engineer in its original location before cutting operations are started.

6.21.03 Construction Methods

(a.) Preparation of Sodded Areas

The area to be sodded shall be made smooth and uniform and parallel to the finished grade and cross-section shown on the plans. The tops and bottoms of all slopes shall be rounded to blend into the natural ground.

(b.) Cutting Sod

Before cutting the sod, the grass shall be cut to leave a length of two or three inches above the surface of the ground. The sod shall be cut to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than two inches. Sod shall be cut in rectangles of not less than ten inches by eighteen inches.

(c.) Laying Sod

The sod shall be moist and shall be placed on a moist earth bed. Sod shall be laid within 24 hours after cutting and shall be properly protected until placed. The sod shall be carefully placed by hand in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward.

The bottom edge of sodded area shall extend at least two inches into the ground or ditch bottom. All other edges of sodded areas shall be turned into the ground and covered with a layer of topsoil at least two inches in depth, which shall be thoroughly compacted so as to conduct the surface water over the edge of the sod.

The transverse joints or sod strips shall be broken and the sod carefully laid to produce tight joints. All spaces between sod strips shall be filled with topsoil. The soil shall be firmly compacted by tamping with an approved tamper immediately after it is placed. After tamping, the sod shall present a smooth, even surface, free from bumps and depressions.

(d.) Seasonal Limitations

The sod shall not be placed during a drought or during the period from June 1 to August 14, unless provided by authorization. Frozen sod shall not be placed nor shall any sod be placed upon frozen soil.

6.21 SODDING (cont'd)

6.21.04 Method of Measurement

Sodding will be measured in place by area in square yards.

6.21.05 Basis of Payment

Sodding will be paid for at the contract unit price per square yard, which price shall be payment in full for preparation of the earth bed, disposal of surplus materials, furnishing materials and completing the work.

6.31 ROADWAY MAINTENANCE AND TRAFFIC CONTROL

6.31.01 Description

The work covered by this specification consists of measures to maintain the roadway, to protect and maintain traffic, and to protect the work while the contract is in force.

6.31.02 General

The Contractor shall notify the Engineer before starting any work that might inconvenience or endanger traffic in sufficient time so that arrangements may be made for closing the road, if necessary, and providing detours, or for providing signs and barricades for the maintenance of traffic.

6.31.03 Methods, Materials, Devices, and Equipment

All work contained within this specification shall apply to Sections 6.31.01 to 6.31.12 of the current edition of the MDOT Standard Specifications.

6.31.04 Method of Measurement

Any work contained within this specification shall be measured as a lump sum.

6.31.05 Basis of Payment

Any work contained within this specification shall be considered as incidental to the contract, unless otherwise noted in the plans or specifications.

6.34 PLASTIC BURIAL CONDUIT

6.34.01 Description

This work shall consist of furnishing and installing, or of installing only when the material is furnished by the City, plastic burial conduit in an approved trench where indicated on the plans or directed by the Engineer.

6.34.02 Materials

Plastic burial conduit shall be two (2) inch diameter PVC type II plastic pipe furnished in suitable lengths up to 200 feet. Fittings and solvents used for making joints shall be those recommended by the pipe manufacturer for direct burial service and shall further be approved by the Engineer.

6.34.03 Construction Methods

Unless otherwise specified, plastic burial conduit shall be placed immediately adjacent to and 9 to 12 inches below the top of street curbing. the plastic burial conduit shall be placed immediately following the removal of the back curb and gutter form. The burial conduit may be in contact with the curb and gutter, but shall not be in contact with any other hard material such as rock, broken concrete, etc.

On any project where plastic burial conduit is specified for installation, said installation shall be continuous for the length specified and shall have no crimps, breaks or other deformities which will prevent the subsequent pulling of wire through said conduit.

All necessary joints shall be made in conformance with the manufacturer's recommendation.

Where the crossing of intersecting streets is required, the conduit run behind the curb shall be continued to approximately five feet beyond the intersecting point of the curb return of the intersecting street, and shall be placed and covered prior to the construction of the curb return. As soon as the forms for the curb return are in place, the exposed ends of the burial conduit shall be turned up and protected until such time as it is suitable to place the burial conduit in the intersecting street. Prior to backfilling of the conduit trench, the Engineer shall be notified and shall cause an inspection to be made of the completed portion of the installation.

6.34.04 Method of Measurement

Plastic burial conduit will be measured in lineal feet per run of conduit along the centerline of the road project.

6.34.05 Basis of Payment

Plastic burial conduit will be paid for at the contract unit price per lineal foot per run of conduit measured along the centerline of the road project, which price shall be payment in full for all excavation, preparation of the trench, furnishing of materials where specified, the installation and jointing of the conduit run, and backfilling of said conduit run.

6.36 GRAVEL DRIVEWAYS

6.36.01 Description

This work shall consist of excavating driveways and backfilling with aggregate to the required cross-section where such driveways are to be built between the curb and sidewalk as shown on the plans or as directed by the Engineer.

6.36.02 Construction

Driveways shall be excavated between the curb and sidewalk to the required width approved by the Engineer and to a depth sufficient to accommodate driveway material as specified on the plans.

The excavation so made shall be backfilled with aggregate meeting the requirements for 22A as specified in Division 7 of the MDOT Standard Specifications. The aggregate material shall be spread uniformly and thoroughly compacted so that the completed gravel driveway contains 5 inches of compacted aggregate material.

6.36.03 Method of Measurement

Gravel driveways shall be measured by area in square yards.

6.36.04 Basis of Payment

Gravel Driveways will be paid for at the contract unit price per square yard, which price shall include excavation, disposal of excavation, furnishing of aggregate and spreading, compacting and leveling of the aggregate as specified.

6.40 PAVEMENT MARKING

6.40.01 Description

This work shall consist of furnishing materials for, and applying pavement markings as indicated herein.

6.40.02 Materials

Pavement Marking Paint shall be Waterborne as specified in the MDOT Standard Specifications for Construction, Current Edition, Section 920.

Glass Beads as specified in the MDOT Standard Specifications for Construction, Current Edition, Section 920.

Other pavement marking materials, as approved by Engineer.

6.40.03 Equipment

The pavement marker shall be truck mounted and capable of applying two (2), four (4) inch minimum width lines in two colors with one pass of the equipment

. The equipment shall have sufficient paint capacity to enable sustained pavement marking operations and shall be equipped so as to assure uniform application of the paint. The equipment shall have mechanical bead dispensers or pressurized bead dispensers. In general, the equipment shall be that necessary to accomplish the marking in a safe, efficient, and workman like manner. The City of Midland reserves the right to inspect the bidder's equipment before making an award of contract.

The use of hand methods and portable equipment will be allowed for painting railroad crossing, school crossing and other specialized markings.

All vehicles used in the marking operation will be equipped with rotating or oscillating flashers which are visible from both the front and rear of the vehicle. The pavement marking vehicle shall be equipped with an Illuminated Target Arrow, type B, capable of being visible from either the front or rear of the vehicle.

The trailing vehicle shall be equipped with an appropriate sign visible from the rear indicating the following legend:

"PAVEMENT MARKING AHEAD"

The trailing vehicle shall also be equipped with an Illuminated Target Arrow, Type B, which shall be visible from the rear.

6.40 PAVEMENT MARKING (cont'd)

6.40.04 General

The routes designated shall be marked in accordance with the provisions contained herein and as directed by the Engineer. The provisions of the Michigan Manual of Uniform Traffic Control Devices, Current Edition, shall be applicable.

Pavement markings shall be paint applied on bituminous or Portland cement concrete surfaces with traffic maintained during the application. Markings shall be four (4) inch minimum width lines either white or yellow as specified in the Proposal or as directed by the Engineer. Markings shall be applied so that they adhere adequately to the surface.

Prior to the application of Pavement Markings, it shall be the Contractor's responsibility that the pavement surfaces are clean and free of all foreign materials.

6.40.05 Layout for Marking

No-Passing Zones will have been surveyed and the limits marked by others. The Manual criteria for 85th percentile Speed (Minimum passing sight distance of 1,000 feet) will have been used unless a lower speed limit is established or unless the Engineer approved a different speed criteria in conformance with Manual requirements. In the event the limits of No-Passing Zones must be established, changed or replaced, this work will be the responsibility of the City of Midland.

All other layout work necessary for the location and placing of centerlines, lane lines, railroad crossing, school crossing, and other specialized markings where required shall be the responsibility of the Contractor, and will not be paid for separately.

6.40.06 Tolerances

New markings and/or retraced markings shall be placed, with reasonable tolerance, in their proper locations. Incorrect or misplaced markings shall be obliterated and remarked in accordance with the Engineer's instructions. Where existing skip lines are to be retraced, per this contract, they may be retraced with a longitudinal tolerance of one foot.

6.40.07 Weather and Time Limitations

Markings shall not be placed when rain is threatening or when the surface to be painted is wet.

The markings shall be performed during the period April 1 to November 15 unless otherwise approved in writing by the Engineer.

The markings shall not be performed on Saturday, Sunday, or legal holidays unless otherwise approved in writing by the Engineer.

6.40.08 Protection of Lines

The protection of the wet paint shall be the responsibility of the Contractor.

6.40 PAVEMENT MARKING (cont'd)

6.40.09 Skip Line

Skip Line of the color specified shall be applied as a four (4) inch minimum width line either on a cycle of 12 1/2 feet of line and 37 1/2 feet of skip, or on a cycle of 10 feet of line and 20 feet of skip, as directed by the Engineer.

Skip line will be measured by length in stations of 100 feet, or in miles, along the line as provided. No deductions in length will be made for skips in Skip Lines. Measurement will not be made when these occur in no Passing Zones.

6.40.10 Double Line

Double Line of the color specified shall be applied as two solid four (4) inch minimum width lines separated by a discernable space.

Double Line will be measured by length in stations of 100 feet, or in miles along the center of the lines. The lines will not be measured for payment separately, and measurement will not be made when these lines occur in No Passing Zones.

6.40.11 Single Line

Single Line of the color specified shall be applied as a solid four (4) inch minimum width line.

Single Line will be measured by length in stations of 100 feet, or in miles along the line as provided. Measurement will not be made when these lines occur in No Passing Zones.

6.40.12 Application Rates

Application Rates for pavement marking materials, including glass beads, shall Be as per Table 811-1 in the MDOT Standard Specifications for Construction, Current Edition.

6.40.13 No Passing Zones

No Passing Zones shall be applied as four (4) inch minimum width solid and skip yellow lines as indicated in figures 3-1b, 3-6, 3-7, and 3-15 of the Michigan Manual of Uniform Traffic Control Devices.

No Passing Zones will be measured by length in stations of 100 feet and shall include both the solid lines and its adjacent Skip Line. The Zone in each lane will be measured for payment separately, and there will be no deduction for overlap of zones. Where No Passing Zones in opposite directions do not overlap, and this distance is a maximum of 400 feet or less, Skip Line will be placed and measured for payment with the item of No Passing Zones.

6.40.14 Specialized Markings

Specialized Markings shall consist of the white markings as named and referenced in the appropriate figure of the Michigan Manual of Uniform Traffic Control Devices.

6.40 PAVEMENT MARKING (cont'd)

6.40.15 Accepting Final Quantities

During application, the Engineer shall make sufficient checks, as deemed necessary, to verify the estimated application rates of the materials and the dimensions of the markings.

The Engineer may verify the final quantities for No Passing Zones from the Final Record of the survey, subject to visual checks for completion in accordance with contract provisions. Checks may be either by measurements or by vehicle odometer readings as considered necessary.

The Engineer may accept final quantities for Lines based on a visual check for completion in accordance with Contract provisions. Annual certifications of road mileages may be used in this check, and spot checks may be made either by measurements or by vehicle odometer readings as considered necessary.

6.40.16 Basis of Payment

Pay Item	Unit
Skip Line	L.Ft., Mile
Double Line	L.Ft., Mile
Single Line	L.Ft., Mile
No Passing Zone	L.Ft., Mile
Railroad Cross Marking	Each
Pavement Edge Line	L.Ft., Mile
Specialized markings	Each

6.41 HOT APPLIED THERMOPLASTIC MARKING-HAND APPLICATIONS

6.41.01 Description

This work includes the furnishing and installation of hot applied thermoplastic pavement markings at locations as designated by the Engineer, and in accordance with the provisions of the current edition of the Michigan Manual of Uniform Traffic Control Devices.

6.41.02 Material

The thermoplastic material shall be a mixture of resins and other materials specifically compounded for traffic markings and which, when properly extruded on the road surface, shall result in a highly reflective marking of maximum durability.

6.41.03 Reflectivity

A sufficient amount of glass beads (refractive index not less than 1.65) shall be included within and also applied to the finished marking, by the drop-on-method, to provide good initial and continuing nighttime reflectivity.

6.41.04 Material Thickness

The applied marking shall have a thickness of .125"+-.015".

6.41.05 Color

White-The luminous directional reflectivity shall not be less than 80 percent.

Yellow-Shall match Color No. 33538 of Federal Standard No. 595.

APPLICATION

6.41.06 General

The thermoplastic material shall be extruded on the road surface by the contractor with small, hand-operated equipment. the layout work of the desired markings shall also be accomplished by the contractor at the locations designated by the Engineer. The equipment shall be capable of placing finished lines free from waviness with lateral deviation not to exceed two (2) inches in fifteen (15) feet.

Abutting applications of thermoplastic material shall be placed in a manner that will eliminate appreciable gaps or overlaps.

An epoxy primer shall be applied to the road surface before placing the thermoplastic material. The contractor shall thoroughly clean the road surface of all debris prior to the application of the epoxy primer and thermoplastic material. The minimum air temperature shall be 50°F while the pavement surface in a dry condition, shall have a minimum of 45°F upon application. The material shall be applied at a minimum of 375°F.

6.41.07 Protection of Markings

The protection of the markings during drying shall be the responsibility of the Contractor.

6.41 HOT APPLIED THERMOPLASTIC MARKING-HAND APPLICATION (cont'd)

6.41.08 Railroad Crossing Markings-Thermoplastic

Railroad Crossing Markings-Thermoplastic shall consist of the white markings indicated in Figure 3-15 of the Michigan Manual of Uniform Traffic Control Devices.

Railroad Crossing Markings-Thermoplastic will be measured by the unit. Measurement will be made individually on each approach lane to the railroad crossing. No Passing Zone Markings at crossing approaches will be measured separately.

6.41.09 Stop Lines-Thermoplastic

Stop Lines-Thermoplastic, of the width specified, shall consist of solid white lines extending across all approach lanes. Stop line width and location shall be as directed by the Engineer.

Stop Lines-Thermoplastic of the width specified will be measured in place, by length in linear feet.

6.41.10 Crosswalks-Thermoplastic

Crosswalks-Thermoplastic, of the type referenced in Figure 3-14 of the Michigan Manual of Uniform Traffic Control Devices, shall consist of solid white lines. The crosswalk, type and line width specified, shall extend across the full pavement width. Crosswalk location shall be as directed by the Engineer.

6.41.11 Specialized Markings-Thermoplastic

Specialized Markings-Thermoplastic as named and referenced will be measured by the unit.

6.41.12 Maintaining Traffic

Necessary warning signs shall be furnished and maintained by the Contractor for the thermoplastic pavement marking operations.

These warning signs shall be placed at suitable locations as designated by the Engineer. It shall be the Contractor's responsibility to have a flagman on the jobsite prior to placing any epoxy primer or thermoplastic material. The Contractor shall insure that a flagman is present and controls traffic during the entire operation of placing the epoxy primer and thermoplastic material. The cost of all flagman activities shall be incidental to the project.

6.41.13 Basis of Payment

Pay Item	Unit
Railroad Crossing Marking-Thermoplastic	Each
Stop Lines-Thermoplastic	Linear Feet
Crosswalks-Thermoplastic	Linear Feet
Specialized Markings-Thermoplastic	Each

6.43 FAST-DRY PAVEMENT MARKING PAINTS-WHITE AND YELLOW

6.43.01 Description

This specification covers fast drying, white and yellow pavement marking paints. The paint will be heated, applied to the pavement, with the white and yellow paints reflectorized with glass beads applied by spray gun.

The paint as furnished shall contain no premixed glass beads as part of the pigment or for reflectorization purposes.

These specifications require road performance evaluations.

6.43.02 General Requirements

(a.) It is the intent of these specifications to procure for use by the Department the best traffic paint possible as determined by application and drying-time, service, and cost. The composition of the paint is left entirely to the manufacturer, and it is his responsibility to produce a paint meeting the requirements specified herein.

(b.) The paint must be suitable for application in the Department's striping equipment designed for this purpose. The paint shall be furnished for use without thinning or other modifications. It shall be uniformly ground, shall not settle badly, skin, get or thicken in the sealed container during a period of one year of storage. After storage it shall be capable of reincorporation by normal methods, for satisfactory application.

6.43.03 Specific Requirements

Samples submitted for performance tests shall meet all of the following specific requirements. Paints not meeting one or more of the specific requirements, will not be filed, evaluated, nor considered for bids.

(a.) Color

(1.) White - The luminous directional reflectivity shall not be less than 80 percent relative to magnesium oxide when tested in accordance with the current Method of Test for 45-Deg, 0-Deg Directional Reflectance of Opaque Specimens by Filter Photometry, ASTM Designation: E 97.

(2.) Yellow - Shall match the standard shade within the green and red tolerance limits when compared with the Color Tolerance Chart for Highway Yellow PR Color #1 of the Federal Highway Administration.

(b.) Consistency - The paint shall have a viscosity of 95 to 125 Krebs Units at 77°F as determined by Method 4281 of Federal Standard 141.

6.43 FAST-DRY PAVEMENT MARKING PAINTS-WHITE AND YELLOW (cont'd)

6.43.03 Specific Requirements (cont'd)

(c.) Drying Time - The paint shall dry to a "no tracking" condition in one minute or less when applied on an unpainted roadway. The "no tracking" condition shall be determined on applied paint stripes, with the paint preheated by the striping equipment to a temperature of 160 to 170°F at the spray gun and the air temperature at 75 ±10°F and the relative humidity under 80 percent. The "no tracking" time shall be determined by a passenger car in a simulated passing maneuver.

For this and other applicable tests, the paint will be applied at the rate of 15 gallons per mile of four (4) inch stripe, with Department Standard Specifications beads applied at six (6) pounds per gallon of white or yellow paint.

(d.) Bleeding - The paint shall have a numerical rating of not less than 4, when tested in accordance with ASTM Designation: D 869. The test shall be performed on beaded stripes.

(e.) Settling - The paint shall have a numerical rating of not less than 6, when tested in accordance with ASTM Designation: D 869.

(f.) Paint, Non-Volatile - The paint shall have a minimum of 70 percent non-volatile when tested by Method 4041 of Federal Standard 141.

6.43.04 Packaging and Marking

Each container shall plainly show, in weather resistant markings, the name of the producer, description of material, purchase order number, date of packaging and volume of contents.

6.44 GLASS BEADS FOR USE IN PAVEMENT MARKINGS

6.44.01 Description

These specifications cover glass beads for reflectorizing white and yellow paint markings on pavements by the drop-in method on fresh paint stripes.

6.44.02 Detail Requirements

a.) General - The glass beads shall be of a transparent, lustrous, water-white glass composition designed to be highly resistant to traffic wear and to the effects of weathering. They shall be spherical in shape, and shall not include more than 20 percent, by count, of irregularly shaped particles. They shall be essentially free of dark particles and of particles showing milkiness, gas inclusions, pits and scratches.

(b.) Gradation - The beads shall conform to the gradation requirements specified herein and will be tested in accordance with the Sieve Analysis of Glass Spheres, ASTM D 1214, using 50 to 100 gram samples obtained by means of a riffle sample splitter.

Sieve No.	Total Percent Passing
30	100
40	70-100
80	0-20
120	0-5

(c.) Index of Refraction - The glass of which the beads are composed shall have an index of refraction of not less than 1.50 by the immersion method using tungsten light.

(d.) Chemical Stability - After testing as described herein, the residual solution shall have an alkalinity number greater than 2.0. The alkalinity number is defined as the number of ml of 0.1 N HCL required to reach the end point.

The test shall be conducted as follows:

Place 100 ml of distilled water in a 250 ml Erlenmeyer flask and bring it to a boil.

Remove flask from heat source and introduce to 10 gram sample of glass beads.

Stopper the flask containing the filtrate and allow to cool to room temperature and then titrate with 0.1 n HCL using phenolphthalein as the indicator.

6.44.03 Packaging and Marking

Each container shall plainly show, in weather resistant markings, the name of the producer, description of material, purchase order number, date of packaging and weight of contents.

6.45 SPRAY APPLIED POLYESTER PAVEMENT MARKING MATERIAL

6.45.01 Type of Material

Material supplied under this specification shall be a two-component polyester system capable of being applied by conventional truck-mounted spray equipment at ambient temperature. Material shall be capable of retaining reflective glass spheres of the drop-on type and shall be suitable for application to either Portland Cement concrete or bituminous pavement.

6.45.02 Composition

(a.) The liquid polyester marking material shall consist of the following components:

	Min.	Max.
Polyester Vehicle	57%	63%
Pigments	27%	33%
Solvent	7%	13%

Each gallon of the white polyester material shall contain not less than 2.25 lbs. of titanium dioxide in accordance with ASTM D-476-70, Type II. Each gallon of yellow polyester shall contain not less than 2.25 lbs. of Medium Chromeyellow in accordance with ASTM D-211-67, Type III.

(b.) The catalytic component of the system shall be any commercially available type such that the entire system when mixed together shall meet the requirements of the Section III and IV.

6.45.03 Physical Requirements

(a.) Viscosity

The viscosity of the uncatalyzed polyester material shall be 90 ±5 K.U. at 25°C determined in accordance with Federal Test Method Standard No. 141a, Method 4281.

(b.) Color

(1.) White - The luminous directional reflectivity shall be not less than 80% relative to magnesium oxide when measured with a 45-0 reflectometer.

(2.) Yellow - Shall match the standard shade within the green and yellow tolerance limits when compared with Standard Yellow Color Chips for Highway Sign and Markings available from the U.S. Bureau of Public Roads, Washington, D.C.

6.45 SPRAY APPLIED POLYESTER PAVEMENT MARKING MATERIAL (cont'd)

6.45.03 Physical Requirements (cont'd)

(c.) Drying Time

Catalyst/resin ratio shall be adjusted by the operator so that the applied line shall dry to a "no tracking" condition in 30 minutes or less provided the pavement temperature is 60°F or higher.

(d.) Bleeding

The catalyzed system shall have a numerical rating of not less than 6 when tested in accordance with ASTM D-969. The test shall be performed on beaded stripes.

(e.) Abrasion Resistance

The catalyzed system shall have a maximum loss in weight of 0.15 gm in 1000 revolutions when abraded according to Federal Test Method Standard No. 141A (Method 6792), using CS-17 Wheels with a 1000 gm load on each wheel.

6.45.04 Application

The polyester system shall be capable of being applied to non-defective pavement surfaces that are free from dirt or other foreign matter.

Material supplied under this specification shall be Contractor applied. All application expenses shall be included in the cost per foot quotation of the polyester material.

Under normal application, the pavement's temperature shall be a minimum of 60°F. Special instruction should be supplied by the vendor for applications to be made at pavement temperatures below 60°F.

Openings of six inches in length shall be left at twenty-foot intervals in edgelines placed on the inside of super-elevated curves in order to prevent the ponding of drainage on the pavement surface. Longitudinal lines do not have to be offset from construction joints of Portland Cement concrete pavements.

During application, reflective glass spheres of the "drop-on" type of such quality so as to provide optimum night visibility shall be injected under pressure into and onto the polyester pavement marking material at a rate of not less than 12 lbs./gallon. The cost of these spheres shall be included in the cost per foot quotation of the polyester material.

6.53 TURF ESTABLISHMENT

6.53.01 Description

This work consist of fundamental turf work, including but not limited to topsoiling, hydroseeding, fertilizing, weed control, erosion control, maintenance, watering and repair of turf as described herein during the life of the contract. The Contractor is responsible for the performance and quality of turf growth in the areas indicated on the plans and as identified by the Engineer.

Establish a durable, permanent, weed-free, mature, perennial turf. Choose and implement proven turf establishment industry practices; provide all necessary labor and equipment; select and provide all turf establishment materials; and control erosion and any subsequent sedimentation at all times.

6.53.02 Materials

All materials necessary to achieve turf establishment shall be furnished by the Contractor.

Soil. Screened topsoil a minimum of 4 inches in depth, capable of supporting vigorous growth, free from subsoil, clay lumps, brush, roots, weeds, litter, stones larger than ½ inch, excess acid or alkali, or any material or substance which may be harmful to plant growth.

Seed. Use a seeding mixture that is composed of four or more species of perennial grass. Use only species and their cultivars or varieties which are guaranteed hardy for Michigan. Recommended species of perennial grasses include: Kentucky Bluegrass, Perennial Ryegrass, Hard Fescue, Creeping Red Fescue, Chewings Fescue, Turf-type Tall Fescue, Buffalo grass, and Alkaligrass-Fults Puccinellia distans. Select cultivars or varieties of grasses that are disease and insect resistant and of good color. Ensure that no one species in the mix is less than 5 percent, or more than 25 percent, of the mixture by weight. Do not select grass species considered noxious or objectionable, such as Quack Grass, Smooth Brome, Orchard Grass, Reed Canary Grass and others.

Ensure the seed is legally saleable in Michigan. Ensure the seed product does not contain more than 10 percent inert materials. Adapt the species and varieties of seed to the site conditions, to the site use, and to the soils, moisture and local climate. Ensure at least two of the species in the mixture proposed to be planted within 15 feet behind the curb or the shoulder are salt tolerant.

Herbicides. Apply herbicide(s) as needed. Comply with all federal, state and local laws. A minimum of 48 hours in advance of applying herbicides, the Contractor shall notify residents via hand-delivered flyers, with content pre-approved by the Engineer. It is the Contractor's responsibility to select the herbicide(s) and the rate at which it is used. Obtain the Engineer's approval of work methods and herbicide(s) selected prior to the application of the herbicide(s). Do not draw water from any waterway (i.e. river, ditch, creek, lake, etc.) located on state, county or municipal right-of-way, for mixing with herbicides.

Fertilizers. Apply fertilizer(s) as needed. It is the Contractor's responsibility to select the fertilizer(s) and the rate at which it is used. Phosphorus is allowed for use only at the time of planting and when required by soil conditions.

Water. Apply water from an approved source at a frequency and rate to promote healthy growth.

Mulch. Mulch used for hydroseeding shall be a blend of wood fiber mulch and paper mulch.

6.53 TURF ESTABLISHMENT (cont'd)

6.53.03 Construction

All labor and equipment necessary to achieve turf establishment shall be provided by the Contractor. The Contractor shall be responsible for determining and employing any and all construction methods, including application rates, necessary to achieve turf establishment, unless noted otherwise within this specification or by the Engineer.

Hydroseeding. The Contractor shall obtain a Hydroseed Authorization Form, signed by the Engineer's agent prior to hydroseeding. Seed, fertilizer, mulch and water shall be mixed to a homogeneous slurry and evenly sprayed over the area to be covered.

Turf Repairs. The contractor shall establish proper erosion control measures, as determined by the Contractor. The contractor shall be responsible for repairing germinated or non-germinated turf that is damaged or adversely affected by rain, wind or any naturally or unnaturally occurring event, throughout the duration of the contract, the cost of which shall be considered incidental to the Turf Establishment pay item.

Turf Maintenance. The contractor shall be responsible for maintaining germinated or non-germinated turf throughout the duration of the contract, including but not limited to erosion control, weed control, fertilization and watering. Lack of maintenance may result in failure to meet acceptance criteria for turf establishment. Maintain turf to a visually appealing level, and not more than 8 inches in height at any time, prior to acceptance. Weeds must be controlled to less than 10 percent of the turf establishment area at all times during construction. Turf maintenance shall be considered incidental to the Turf Establishment pay item.

Acceptance of Work. The Contractor will notify the Engineer when the Contractor believes turf establishment has been achieved. Successful turf establishment is defined as no exposed bare soil with turf fully germinated, erosion free, weed free, disease free, dark green in color and in a vigorous growing condition.

The Engineer will perform an outlawn inspection and accept or reject the work. If the work is rejected, the Contractor shall perform additional work until turf establishment has been achieved, as determined by the Engineer, at no additional cost to the City. The full amount of the contract retainage will be withheld until turf establishment has been achieved at all locations within the contract limits, as determined by the Engineer.

If the Contractor does not agree with the decision made by the Engineer, the Contractor may request an inspection by a mutually agreed upon third party (Michigan State University Extension service or other). A joint inspection, to include the Engineer, the Contractor, and the third party, will be scheduled by the Engineer. All costs related to third party inspection shall be paid by the Contractor.

The Contractor shall make a reasonable effort to establish turf during the same growing season in which the contract was let. However, the Contractor may choose to postpone hydroseeding until no later than May 31 of the following growing season, provided topsoil is placed and neatly graded in the current growing season. In this case, the full contract retainage will be withheld until the work is accepted by the Engineer in the following growing season.

6.53 TURF ESTABLISHMENT (cont'd)

6.53.04 Measurement and Payment

The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Turf Establishment……	Square Yard