

Section 626—Trees, Shrubs, Vines, & Ground Cover

Description

626.01 Work. Furnish and plant trees, shrubs, vines, and ground cover plants.

Materials

626.02 Requirements. Ensure that materials meet the requirements specified in the following subsections:

Topsoil	713.01
Fertilizer	713.03
Mulch	713.05
Plant Materials	713.06
Miscellaneous Planting Material	713.08
Water	725.01(b)

Construction

626.03 Performance. Follow the specifications below.

(a) Planting Seasons. Plant during the seasons indicated in the SPECIAL PROJECT SPECIFICATIONS. Do not plant in frozen ground, when snow covers the ground, or when the soil is in an unsatisfactory condition for planting.

(b) Delivery & Inspection. Notify the CO not less than 15 days before plants are delivered. Inform the CO about the source of supply and the shipping dates for all plant material. Ensure that all plant materials comply with State and Federal laws applicable to inspection for plant diseases and insect infestations. Deliver all required certificates of inspection to the CO.

(c) Protection & Temporary Storage. Keep all plant material moist. Protect plants when they are in transit, in temporary storage, or on the project site awaiting planting.

(d) Layout. Designate the locations of plant material and bed outlines on the project site so they conform to the lines, grades, and elevations SHOWN ON THE DRAWINGS. The CO may adjust plant material locations to meet field conditions.

(e) Excavation for Plant Pits & Beds. Do not excavate plant pits and beds until the layout is approved. Remove and dispose of all sod, weeds, roots, and other objectionable material that is unsuitable for backfill.

For root spreads from 600 to 1,200 mm, make pit diameters 600 mm greater than the root spread. For root spreads over 1,200 mm, make pit diameters one and one-half times the root spread.

Ensure that all pits are deep enough to permit a minimum of 150 mm of loam–humus backfill under all roots or balls. Excavate to sufficient depth to plant at the root collar.

Loosen the soil at the bottom of the plant pit to a depth of at least 150 mm before backfilling or planting begins.

(f) Prepared Backfill Soil. Prepare the backfill soil to consist of a mixture of four parts topsoil, loam, or selected soil, and one part peat moss or peat humus.

(g) Setting Plants. Set all plants approximately plumb and at the same level, or not more than 25 mm lower than the depth at which they were grown in the nursery or collecting field.

(1) Bare Root Stock. Place prepared backfill soil in the plant pit to the required depth. Then place bare-rooted plants in the center of the plant pit and spread out the roots in a natural position. Cleanly cut back all broken or damaged roots to sound root growth.

Carefully work backfill soil around and over the roots, then settle it by firming or tamping. Thoroughly water or puddle around bare-rooted plants. Form earth saucers or water basins with a diameter equal to the plant, at least 100 mm deep for trees, and 75 mm deep for shrubs, around individual plants.

(2) Balled & Burlapped Stock. Carefully place balled and burlapped plants in the prepared pits on the required depth of tamped backfill soil so they are in a firm, upright position. Put backfill soil around the plant ball to half the depth of the ball, then tamp and thoroughly water. Cut away the burlap and remove it from the upper half of the ball, or loosen and fold it back. Place the remainder of the backfill. Provide earth saucers or water basins, and thoroughly water the plant.

(h) Fertilizing. Use the types and rates of fertilizer application for the different plants that are shown in the SPECIAL PROJECT SPECIFICATIONS. Uniformly apply fertilizer within 5 days after planting, and cultivate it into the top 50 mm of the plant pit area or shrub bed. Work the proper amount of fertilizer for each type of plant into the prepared backfill material. Apply fertilizer before mulching plant pits or shrub beds.

(i) Watering. Water all plants during and immediately after planting, and at intervals specified in the SPECIAL PROJECT SPECIFICATIONS. Ensure that

water does not contain elements toxic to plant life. Thoroughly saturate the soil around each plant at each watering.

(j) Guying & Staking. Immediately after planting, guy and stake all trees as SHOWN ON THE DRAWINGS. Do not contact the roots when staking.

(k) Wrapping. Wrap deciduous trees only. Completely wrap tree trunks that are 50 mm in diameter or larger with burlap or other approved material. Begin wrapping at the base of the tree, extend it to the first branches, and tie it adequately. Do not wrap tree trunks until they have been inspected and approved. Finish wrapping tree trunks within 24 hours after approval.

(l) Antidesiccant Spray. An approved antidesiccant spray may be used in place of wrapping.

(m) Pruning. Prune plants before or immediately after planting in a manner that will preserve their natural character. Employ experienced personnel who use proper equipment and accepted horticultural practices when pruning. Paint cuts that are over 20 mm in diameter with an approved tree wound dressing.

(n) Mulching. Furnish and place mulch over all pit or saucer areas of individual trees and shrubs, and completely over shrub beds to the depth SHOWN ON THE DRAWINGS. Ensure that mulch is as SHOWN ON THE DRAWINGS or in the SPECIAL PROJECT SPECIFICATIONS. Put 3.5 kg of nitrogen per cubic meter of mulch material around plants to be mulched with wood chips, in addition to the normal dressing of commercial fertilizer. Mulch the plantings within 24 hours after fertilizing is completed.

626.04 Restoration & Cleanup. Restore grass areas that have been damaged or scarred during planting to their original condition. Clean up debris, spoil piles, containers, and so forth.

626.05 Plant Establishment Period & Replacement. During the plant establishment period, which is one full growing season, use all possible means to keep the plants in a healthy growing condition. There will be a semifinal inspection 15 days before the end of the full growing system. At the end of the establishment period, the CO will determine if the plantings are acceptable. Water, cultivate, prune, repair and adjust guys and stakes, and perform other maintenance during the establishment period. Promptly remove dead or unsatisfactory plants. During the next planting season, replace all dead and unsatisfactory plants in kind with robust, healthy plants. Use alternative or substitute varieties only if approved. There will be a final inspection of these plants within 15 days after planting is completed.

Measurement

626.06 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Include in the quantities only living plants that are in healthy condition at the time of final inspection, as specified in Subsection 626.05.

Payment

626.07 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
626 (01) _____, <i>Name of plant</i>	_____ <i>Size</i> Each
626 (02) Plant materials	Lump Sum

Section 628—Sprigging

Description

628.01 Work. This work consists of furnishing and planting living grass plants. Sprigging is designated as broadcast, row, or spot, according to Subsection 628.06.

Materials

628.02 Requirements. Provide material that meets requirements specified in the following subsections:

Agricultural Limestone	713.02
Fertilizer	713.03
Mulch	713.05
Sprigs	713.09
Water	725.01(b)

Construction

628.03 General. Do not sprig during windy weather or when the ground is dry, excessively wet, frozen, or otherwise unillable.

628.04 Harvesting Sprigs. Provide at least 5 days notice before harvesting sprigs. Before harvesting, mow grass and weeds to a height of 65 ± 15 mm and remove all clippings.

Loosen sprigs by cross-disking, shallow plowing, or other acceptable methods. Gather the sprigs in small piles or windrows, water, and keep moist until planting. Dispose of sprigs that freeze or dry out.

628.05 Preparing the Soil. Clear and grade the area to be sprigged. Cultivate, disk, harrow, or otherwise loosen the grade to a depth of not less than 100 mm. Remove stones larger than 50 mm in any diameter, sticks, stumps, and other debris that might interfere with proper placement or subsequent growth.

Place topsoil according to Section 624.

Apply fertilizer and agricultural limestone uniformly over the sprigging area at the application rates SHOWN ON THE DRAWINGS. Mechanical spreaders or blower equipment may be used. Disk or till the fertilizer and limestone into the soil to a depth of 100 mm.

Moisten the prepared soil.

628.06 Planting Sprigs. Plant the sprigs within 24 hours after harvesting.

(a) Broadcast Sprigging. Broadcast sprigs by hand or using suitable equipment in a uniform layer over the prepared surface, with spacing between sprigs not to exceed 150 mm. Force the sprigs into the soil to a depth of 75 ± 25 mm with a straight spade, disk harrow, or other equipment.

(b) Row Sprigging. Open furrows along the approximate contour of slopes. Place sprigs in a continuous row in the open furrow, with successive sprigs touching. Cover the sprigs immediately.

(c) Spot Sprigging. Spot sprig according to Subsection 628.06(b), except that instead of planting in a continuous row, group four or more sprigs 500 mm apart in the rows.

After planting, clear the surface of stones larger than 25 mm, large clods, roots, and other litter brought to the surface during sprigging. Lightly compact the sprigged area within 24 hours. Do not compact when the soil is so wet that it is picked up by the equipment. Do not compact clayey soils.

When mulch is required, cover the sprigged area with mulch within 24 hours, in accordance with Subsection 625.06.

628.07 Maintaining Sprigged Areas. Keep the sprigged areas moist. Water carefully to avoid erosion. Erect warning signs and barriers to protect newly sprigged areas. Regrade and resprig all areas damaged.

Measurement

628.08 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Measure sprigging by the hectare or square meter on the ground surface. Measure topsoil under Subsection 624.07.

Payment

628.09 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
628 (01) _____ sprigging	Hectare
628 (02) _____ sprigging	Square Meter

Section 629—Sodding

Description

629.01 Work. Prepare the sod bed, and furnish, cut, haul, and lay live sod of perennial turf-forming grasses.

Materials

629.02 Requirements. Ensure that materials meet the requirements specified in the following subsections:

Agricultural Limestone	713.02
Fertilizer	713.03
Pegs for Sod	713.11
Sod	713.10
Water	725.01(b)

Construction

629.03 Season. Sod during the season SHOWN ON THE DRAWINGS or in the SPECIAL PROJECT SPECIFICATIONS.

629.04 Sources of Sod. The CO will approve sod obtained from other than commercial sources, in the original position, before cutting and delivery to the project. Notify the CO at least 5 days before cutting begins.

629.05 Soil Preparation & Cleanup. Bring areas to be sodded to the lines and grades SHOWN ON THE DRAWINGS, then plow, disk, harrow, or otherwise loosen them before sod is delivered. Remove stones larger than 50 mm in diameter, sticks, stumps, and other debris that might interfere with the proper laying or subsequent growth of sod.

629.06 Topsoiling. Place topsoil where SHOWN ON THE DRAWINGS. Remove and dispose of large clods, stones larger than 50 mm in any dimension, roots, stumps, and other litter at locations SHOWN ON THE DRAWINGS.

629.07 Applying Fertilizer & Ground Limestone. After soil preparation, cleanup, and topsoiling, uniformly spread fertilizer and ground limestone, when specified, at the rate SHOWN ON THE DRAWINGS or in the SPECIAL PROJECT SPECIFICATIONS. Use mechanical spreaders, blower equipment, or other approved methods to spread fertilizer and ground limestone. Incorporate these materials into the soil by disking or other tillage.

629.08 Laying Sod. Lay sod on the prepared bed within 24 hours after cutting, except when stored in stacks or piles, grass to grass and roots to roots, for not more than 5 days. Protect sod from drying by sun or wind and from freezing. Move and lay sod when weather conditions and soil moisture are favorable.

Lay sod according to one or more of the following methods, as DESIGNATED IN THE SCHEDULE OF ITEMS:

- (a) Lay solid sodding when soils are moist. Thoroughly moisten dry sod bed areas before laying sod. Lay sections of solid sod edge to edge with staggered joints. Plug openings with sod or fill them with acceptable loamy topsoil. After laying and filling joints, roll or tamp the sod to eliminate air pockets and make an even surface. On slopes of 1:0.5 or steeper and in channels, peg sod on approximate 600-mm centers after tamping. Drive pegs flush with the sod bed surface.
- (b) Lay strip sod in parallel rows of the width SHOWN ON THE DRAWINGS. Lay sod in a shallow trench and firmly roll or tamp it until the surface is level with or below the adjacent soils. If SHOWN ON THE DRAWINGS or in the SPECIAL PROJECT SPECIFICATIONS, seed the ground between strips of sod with grass seeds of the kind and at the rates specified. Then rake or drag the seeded areas to cover the seed.
- (c) Perform spot sodding by laying sod blocks as SHOWN ON THE DRAWINGS. Firmly roll or tamp the pieces into the soil until the surfaces of sod blocks are slightly below the surrounding ground surface.

629.09 Care During Construction, Watering, & Temporary Maintenance of Sodded Areas. Water the sod when it is laid and keep it moist until final acceptance of the contract. Distribute water evenly at a measured rate per unit of area. Water to avoid erosion and prevent damage to sodded areas.

Erect necessary warning signs and barriers; mow sodded areas; repair or replace sodded areas that fail to show a uniform growth of grass or are damaged by construction operations; and otherwise maintain the sod until final acceptance of the contract.

Replace dried-out or damaged sod at no charge to the Government.

Measurement

629.10 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Base area computations upon surface measurement.

Payment

629.11 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
629 (01) Solid sodding	Square Meter
629 (02) Strip sodding	Square Meter
629 (03) Spot sodding	Square Meter

Section 633—Signs

Description

633.01 Work. Install only, or furnish and install, delineators, markers, signs, sign supports, panels, and posts; or remove and dispose of existing signs, posts, and hardware.

633.02 Traffic Control Sign Details. Ensure that traffic control signs meet the requirements of the MUTCD and details as SHOWN ON THE DRAWINGS.

Materials

633.03 Requirements. Furnish materials that meet the requirements specified in the following subsections:

Aluminum Panels	718.05
Conventional Traffic Paint	718.16
Delineator & Object Marker Retroreflectors	718.15
Edge Film	718.10
Epoxy Markings	718.18
Epoxy Resin Adhesives	718.26
Extruded Aluminum Panels	718.07
Glass Beads	718.22
Hardware	718.13
Letters, Numerals, Arrows, Symbols, & Borders	718.14
Object Marker & Delineator Posts	718.12
Paint	718.08
Plastic Panels	718.06
Plywood Panels	718.03
Polyester Markings	718.19
Preformed Plastic Markings	718.21
Raised Pavement Markers	718.23
Retroreflective Sheeting	718.01
Signposts	718.11
Silk Screen Inks	718.09
Steel Panels	718.04
Temporary Pavement Markings	718.24
Temporary Traffic Control Devices	718.25
Test Procedures	718.02
Thermoplastic Markings	718.20
Waterborne Traffic Paint	718.17

Furnish certification to the CO that all materials comply with the specified requirements.

Ensure that all concrete meets the requirements specified in Section 602, or as SHOWN ON THE DRAWINGS.

Furnish reinforcing steel as SHOWN ON THE DRAWINGS that meets the requirements specified in Subsection 709.01.

Construction

633.04 Fabrication of Sign Panels. Fabricate all parts in a uniform manner. Complete all panel fabrication, including cutting, punching, and drilling of holes, prior to final surface preparation and application of reflective sheeting, except where required for the fabrication of diecut or sawed letters on processed and mounted signs. Ensure that workmanship is of high quality, and that there are no visible defects in the finished product.

(a) Sign Panel Preparation. Cut sign panel from the specified substrate material. Ensure that it is flat and free of warp and any defects that interrupt smooth continuity of the panel surface. Prepare all panels precisely as described in writing by the substrate and sheeting manufacturers.

For sign panels smaller than 1.2 x 2.4 m, cut them from a single sheet of substrate material without joints.

For high-density overlay (HDO) substrate sign panels larger than 1.2 x 2.4 m, fabricate in sections using 19-mm-thick material. Prepare individual panel sections to be joined using doweled butt joints. Use dowels that are 9-mm threaded bolt stock and 112 mm in length. Place them 50 mm from each side, and every 300 to 375 mm along the joint. Do not actually join the individual panels until sign installation.

Make panels of the dimensions that are SHOWN ON THE DRAWINGS, with a tolerance of ± 6 mm.

(b) Beveling. Slightly round or bevel all edges of sign panels to eliminate edge sharpness.

(c) Drilling. Drill holes at the locations and to the sizes that are SHOWN ON THE DRAWINGS. Debur all holes. Do not field drill holes in any part of the structural assembly without the approval of the CO.

(d) Surface & Edge Finishing. Fill all core-cap holes on HDO plywood signs with an exterior wood dough, sanded with medium grit (50–60) sandpaper to

produce a smooth surface. Apply one coat of paint to the edges prior to application of background sheeting.

(e) *Sheeting, Legend, Border, & Symbol Application.* Apply all sheeting, legend, border, and symbols precisely as prescribed in writing by the sheeting manufacturer. Either pressure-sensitive or heat-activated material may be used, as SHOWN ON THE DRAWINGS. Cover the entire face of the sign panel with one unspliced sheet if the panel is less than 1.2 m in either dimension. On each section, use horizontal splicing only. Color match materials, and ensure that splices do not coincide with any legend. Ensure that the top piece overlaps the bottom piece by at least 12 mm.

Ensure that all letters, layout, and spacing are as specified in the Federal Highway Administration's (FHWA's) "Standard Alphabets for Highway Signs," current edition, and as SHOWN ON THE DRAWINGS. Apply the following tolerances:

- (1) Horizontally align letters, numerals, and symbols to a tolerance of ± 3 mm.
- (2) Vertically align letters, numerals, and symbols to a tolerance of ± 2 mm.
- (3) Ensure that spacing between lines does not exceed a tolerance of ± 3 mm.

(f) *Silk-Screening.* Perform all silk-screening operations precisely as prescribed in writing by the manufacturers of the ink and the sheeting. Use direct screen process to apply messages and borders that are darker in color than the sign background. Use the reverse screen process to produce messages and borders that are lighter in color than the sign background. Screen to produce uniform colors and tone, with sharply defined edges of legend and border, and without blemishes on the sign background.

Color-match silk-screened inks to eliminate any visual difference between silk-screened material and applied material of the same color on the same sign.

(g) *Trimming & Edge Finishing.* After all sheeting, legends, borders, and symbols have been applied to the substrate, trim all excess material flush with the edge of the sign panel. Sheeting may overlap HDO plywood substrate sign edges by 3 mm. Finish the edges of HDO substrate panels with a second coat of paint applied in accordance with the recommendation of the paint manufacturer.

(h) *Edge Film.* When SHOWN ON THE DRAWINGS, apply edge tape over the entire top edge of the panel precisely as prescribed in writing by the manufacturer of the material being used.

(i) *Maker's Mark.* Install a decal showing the Contractor's identification or trademark and the date of manufacture on the back upper left-hand corner of each sign.

633.05 Delineator Posts & Housing. Drive delineator posts at locations and to the depth SHOWN ON THE DRAWINGS. Attach the delineator housing to the post, in accordance with the manufacturer's direction.

633.06 Sign Erection. Erect sign supports plumb and in accordance with the details SHOWN ON THE DRAWINGS. Make length of supports as SHOWN ON THE DRAWINGS, and in accordance with MUTCD, or as described in the SCHEDULE OF ITEMS.

Securely fasten the sign panels to the posts, as SHOWN ON THE DRAWINGS.

To reduce specular glare, erect the sign panel face in accordance with MUTCD, section 2A-26.

633.07 Sign Removal. Remove sign assemblies that are to be replaced, as SHOWN ON THE DRAWINGS. Ensure that sign replacement assemblies are replaced within 24 hours. Dispose of all removed sign material as SHOWN ON THE DRAWINGS. Remove signposts to a minimum of 75 mm below natural ground line. Backfill and compact remaining post holes with suitable material. When regulatory and warning signs are removed, immediately place replacement signs.

Measurement

633.08 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Compute quantities of sign face area using the dimensions SHOWN ON THE DRAWINGS.

Make no deduction for rounded corners.

Compute the area for irregularly shaped signs, such as "Stop" signs, by multiplying the extreme width by the extreme height of the sign face.

For sign removal, treat an assembly of posts and signs as only one sign when these materials are integrally connected and standing at one location.

Payment

633.09 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
633 (01) Wood posts	Meter
633 (02) Steel posts	Meter
633 (03) Aluminum posts	Meter
633 (04) Plastic posts	Each
633 (05) Fiberglass-reinforced plastic posts	Each
633 (06) Aluminum sign panels	Square Meter
633 (07) Plywood sign panels	Square Meter
633 (08) Steel sign panels	Square Meter
633 (09) Plastic sign panels	Square Meter
633 (10) Fiberglass-reinforced plastic sign panels	Square Meter
633 (11) Delineators	Each
633 (12) Sign	Each
633 (13) Sign removal	Each
633 (14) Sign and post(s), installation only	Each
633 (15) Regulatory signs	Each
633 (16) Warning signs and markers	Each
633 (17) Object markers	Each

Section 634—Painted Traffic Markings

Description

634.01 Work. Apply permanent pavement markings and raised pavement markers on the completed pavement.

Pavement markings are designated as follows:

Type A	Conventional traffic paint with type 1 glass beads
Type B	Waterborne traffic paint with type 1 glass beads
Type C	Waterborne traffic paint with type 3 glass beads
Type D	Epoxy markings with type 1 glass beads
Type E	Epoxy markings with type 1 and type 4 glass beads
Type F	Polyester markings with type 1 glass beads
Type G	Polyester markings with type 1 and type 4 glass beads
Type H	Thermoplastic markings with type 1 glass beads
Type I	Thermoplastic markings with type 1 and type 5 glass beads
Type J	Preformed plastic markings
Type K	NonreflectORIZED markings

Materials

634.02 Requirements. Furnish material that conforms to the MUTCD and the following subsections:

Conventional Traffic Paint	718.16
Epoxy Markings	718.18
Epoxy Resin Adhesives	718.26
Glass Beads	718.22
Polyester Markings	718.19
Preformed Plastic Markings	718.21
Raised Pavement Markers	718.23
Thermoplastic Markings	718.20
Waterborne Traffic Paint	718.17

Construction

634.03 Performance. Where existing and final pavement marking locations are identical, stake the limits of all existing pavement markings (no-passing zones, edge stripes, etc.) before any pavement work. Upon completion of the final

surface course, establish line limits for the new pavement for approval before marking. Establish markings according to the MUTCD.

Remove loose particles, dirt, tar, grease, and other deleterious material from the surface to be marked. Where markings are placed on Portland cement concrete pavement less than 1 year old, clean the pavement of all residue and curing compounds. Remove temporary pavement markings the same day permanent pavement markings are applied. Apply markings to a clean, dry surface according to the MUTCD.

Furnish a written copy of the manufacturer's marking recommendations to the CO at least 7 days before starting pavement marking application. A field demonstration may be required to verify the adequacy of recommendations.

Ship marking material in appropriate containers plainly marked with the following information, as appropriate for the material being furnished:

- (a) Manufacturer's name and address.
- (b) Name of product.
- (c) Lot/batch numbers.
- (d) Color.
- (e) Net weight and volume of contents.
- (f) Date of manufacture.
- (g) Date of expiration.
- (h) Statement of contents, if mixing of components is required.
- (i) Mixing proportions and instructions.
- (j) Safety information.

Apply pavement markings in the direction of traffic according to the manufacturer's recommendations. Apply all markings to provide a clean-cut, uniform, and workmanlike appearance by day and night.

Make lines 100 mm wide. Make broken lines 3 m long, with 9-m gaps. Make dotted lines 0.5 m long, with 1.0-m gaps. Separate double lines with a 100-mm space.

Protect marked areas from traffic until the markings are dried to no-tracking condition. Remove all tracking marks, spilled marking material, markings in unauthorized areas, and defective markings.

634.04 Conventional Traffic Paint (Type A). Apply paint when the pavement and air temperatures are above 4 °C. Spray paint at a 0.38-mm minimum wet film thickness before glass beads, or at a rate of 2.6 m²/L. Immediately apply glass beads on the paint at a minimum rate of 0.7 kg/L of paint.

Apply two coats with glass beads to all centerline stripes. Coats are applied in opposite directions on bituminous surface treatment or chip seal surfaces. Second coats are applied from 4 to 48 hours after the first coat.

634.05 Waterborne Traffic Paint (Types B & C). Apply paint when the pavement and air temperatures are above 10 °C. Spray paint at 0.38-mm minimum wet film thickness before glass beads, or at a rate of 2.6 m²/L.

(a) **Type B.** Immediately apply type 1 glass beads on the paint at a minimum rate of 0.7 kg/L of paint.

(b) **Type C.** Immediately apply type 3 glass beads on the paint at a minimum rate of 1.4 kg/L of paint.

Apply two coats with glass beads to all centerline stripes. Coats are applied in opposite directions on bituminous surface treatment or chip seal surfaces. Second coats are applied from 4 to 48 hours after the first coat.

634.06 Epoxy Markings (Types D & E). Heat components A and B separately at 43 ± 17 °C and mix. Discard all material heated over 60 °C. Apply epoxy when the pavement and air temperatures are above 10 °C. Apply as a spray at 43 ± 17 °C (gun tip temperature) at a 0.38-mm minimum dry film thickness, or a rate of 2.6 m²/L.

(a) **Type D.** Immediately apply type 1 glass beads on the epoxy at a minimum rate of 1.8 kg/L of epoxy.

(b) **Type E.** Use two bead dispensers. Immediately apply type 4 glass beads on the epoxy at a minimum rate of 1.4 kg/L of epoxy, immediately followed by an application of type 1 glass beads at a minimum rate of 1.4 kg/L.

634.07 Polyester Markings (Types F & G). Apply polyester when the pavement and air temperatures are above 10 °C. Spray at 53 ± 4 °C (gun tip temperature) at a 0.38-mm minimum dry film thickness, or at a rate of 2.6 m²/L. Discard all material heated over 66 °C. Do not use fast-dry polyester markings on hot asphalt concrete pavements that are less than 1 year old.

(a) **Type F.** Immediately apply type 1 glass beads on the polyester at a minimum rate of 1.8 kg/L of polyester.

(b) **Type G.** Use two bead dispensers. Immediately apply type 4 glass beads on the polyester at a minimum rate of 1.4 kg/L of polyester, immediately followed by an application of type 1 glass beads at a minimum rate of 1.4 kg/L.

634.08 Thermoplastic Markings (Types H & I). On areas to be marked on Portland cement concrete pavements and old asphalt pavements, apply an epoxy resin primer/sealer according to the thermoplastic manufacturer's recommendations. Allow the primer/sealer to dry.

Apply thermoplastic when the pavement and air temperatures are above 10 °C. Spray or extrude the thermoplastic at 220 ± 3 °C. For centerlines and lane lines, spray or extrude a 2.3-mm minimum dry film thickness, or at a rate of 0.44 m²/L. For edge lines, spray or extrude a 1.5-mm minimum dry film thickness, or at a rate of 0.66 m²/L.

(a) **Type H.** Immediately apply type 1 glass beads on the thermoplastic at a minimum rate of 0.59 kg/m².

(b) **Type I.** Use two bead dispensers. Immediately apply type 5 glass beads on the thermoplastic at a minimum rate of 0.59 kg/m², immediately followed by an application of type 1 glass beads at a minimum rate of 0.59 kg/m².

Ensure that the minimum bond strength of the thermoplastic is 1.2 MPa on Portland cement concrete pavements.

634.09 Preformed Plastic Markings (Type J). Install to form a durable, weather-resistant bond to the pavement. Apply preformed plastic markings according to the manufacturer's recommendation.

Where applied during final compaction of asphalt pavement, apply preformed plastic when the pavement temperature is about 60 °C. Roll the marking onto the surface with a steel-wheeled roller. The finished pavement marking may extend approximately 0.25 mm above the final surface.

634.10 Nonreflectorized Markings (Type K). Apply conventional traffic paint, waterborne traffic paint, epoxy markings, polyester markings, or thermoplastic markings as described above, but with no glass beads added.

634.11 Raised Pavement Markers. Install raised pavement markers when the pavement and air temperatures are above 10 °C. Apply raised pavement markers with epoxy resin or asphalt adhesive.

Heat epoxy components A and B separately with indirect heat; mix, and apply at 21 ± 6 °C. Discard all material heated over 49 °C or stiffened by polymerization.

Heat and apply asphalt adhesives at 211 ± 7 °C. Discard all material heated over 232 °C.

Space and align the markers to within 13 mm of the required location. Do not place raised pavement markers over pavement joints.

Make the minimum bond strength 12 kPa, or a total tensile strength of 110 N.

Measurement

634.12 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Measure pavement markings by the meter, kilometer, liter, or square meter.

When pavement markings are measured by the meter or kilometer, measure the length of line applied along the centerline of each 100-mm-wide line applied, regardless of color. Measure broken or dotted pavement lines from end to end of the line, including gaps. Measure solid pavement lines from end to end of each continuous line. For line widths other than 100 mm, the measured length of line is adjusted in the ratio of the required width to 100 mm.

When pavement markings are measured by the square meter, measure the number of square meters of symbol or letter marking based on the marking area shown in the contract or, if not shown, the area of each marking measured in place to the nearest square meter.

Measure raised pavement markers by the each.

Payment

634.13 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
634 (01) Pavement markings, type _____, color _____	Meter
634 (02) Pavement markings, type _____, color _____	Kilometer
634 (03) Pavement markings, type _____, color _____	Square Meter
634 (04) Pavement markings, type _____, color _____	Liter
634 (05) Raised pavement markers, type _____, color _____	Each

Section 637—Equipment Rental

Description

637.01 Work. Furnish and operate equipment for construction work ordered by the CO and not otherwise provided for under the contract.

Equipment

637.02 Requirements. The CO will order in writing rental equipment for use on the project. Submit the model number and serial number for each piece of equipment before use. Make equipment available for inspection and approval before use.

Furnish and operate equipment with such auxiliary attachments, oilers, and so forth, as are usually needed for efficient operation of the equipment. Keep the equipment in good repair and capable of operating 90 percent of the working time.

Obtain approval for the length of workday and workweek before beginning work. Keep daily records of the number of unit-hours of operation. Submit the records along with certified copies of the payroll.

Measurement

637.03 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Measure rental equipment by the hour. When the equipment is operated part-time in any half shift and is operative and not used on other work during the half shift, measure the full half shift. Measure time in excess of 40 hours per week at the same rate as the first 40 hours.

Do not make deductions for nonoperating time for reasonable interruptions for minor repairs if the nonoperating time does not exceed one-half hour per workday. Do not measure nonoperating time in excess of the one-half hour per workday. Do not measure equipment dependent upon another piece of nonoperable equipment.

Do not measure standby time, or time for moving equipment to or from the project or between project worksites.

Measure quantities to include the actual hours, to the nearest half hour, that the equipment is in operation performing the required work. Each day, record the actual hours that the equipment is in operation on the required work.

Payment

637.04 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
637 (01) _____ <i>Type and size of equipment</i>	Hour

Section 640—Road Closure Devices

Description

640.01 Work. Furnish and install, or install only, road closure devices using fabricated gates and accessories, combination post and rail barriers, concrete barriers, earth mound barriers, and other devices as SHOWN ON THE DRAWINGS.

Materials

640.02 Requirements. Furnish materials to be used in fabricating gates and barriers as SHOWN ON THE DRAWINGS.

Furnish metal beam elements, steel posts, structural steel, and steel pipe that meet the requirements SHOWN ON THE DRAWINGS.

Ensure that all hardware is galvanized in accordance with AASHTO M 232 and meets the requirements of ASTM A 307. Furnish plain or cut washers that are American Standard Washers.

Furnish timber posts, rails, and lumber that meet the requirements of AASHTO M 168. Provide timber of the species and type, and rate of preservative treatment, that are SHOWN ON THE DRAWINGS.

Furnish concrete that meets the requirements of Subsection 602.03, method B or C, as SHOWN ON THE DRAWINGS.

Construct earth mound barriers as SHOWN ON THE DRAWINGS from excavated material adjacent to the barrier location, or from other locations as SHOWN ON THE DRAWINGS.

Construction

640.03 Performance. Place road closure devices at the location SHOWN ON THE DRAWINGS. Construct all devices to the dimensions SHOWN ON THE DRAWINGS.

In assembling gates, perform required welding in accordance with the best modern practice and the applicable requirements of AWS D1.1.

After assembly, clean nongalvanized steel pipe gates and paint them with one coat of zinc-rich primer and two coats of exterior enamel of the type and color SHOWN ON THE DRAWINGS or in the SPECIAL PROJECT SPECIFICATIONS.

Set all posts vertically and embed them to the depth SHOWN ON THE DRAWINGS. Place concrete for embedment against undisturbed earth within an excavation sized to achieve the embedment dimensions. Compact the backfill in 150-mm layers to finished grade.

Furnish and install all signs and/or reflective warning markers accessory to the road closure device, as SHOWN ON THE DRAWINGS.

Measurement

640.04 Method. Use the method of measurement that is DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment

640.05 Basis. The accepted quantities will be paid for at the contract unit price for each PAY ITEM DESIGNATED IN THE SCHEDULE OF ITEMS.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
640 (01) Furnish and install road closure device, type _____, size _____	Each
640 (02) Install road closure device, type _____, size _____	Each
640 (03) Furnish and install road closure barrier, type _____, size _____	Each
640 (04) Install road closure barrier, type _____, size _____	Each