

## Section 810. PERMANENT TRAFFIC SIGNS AND SUPPORTS

**810.01 Description.** Furnish, fabricate, and erect traffic signs and supports according to the *Michigan Manual of Uniform Traffic Control Devices (MMUTCD)*, the Michigan Standard Highway Signs Manual, and the Department Sign Support Typical Plans.

### A. Terminology.

**Defect.** Physical imperfection affecting function, performance, or durability of a sign or support. (Dent, scratch, nick, blemish, mottle, dark spot, scuff, streak, warpage, sheeting lift.)

**Patch.** A small piece of reflective sheeting material used to cover a defect or imperfection on a sign surface.

**Post Spacing.** Center-to-center distance between posts.

**Substrate.** Material to which sheeting is applied (wood or aluminum).

**Warp.** Deformation caused by bending or twisting in posts or substrate.

**Wedge.** Tapered hardwood used to secure wood posts in sleeves.

**810.02 Materials.** Use materials meeting the following.

Concrete, Grade P2, P1 .....	601
Concrete, Grade S2.....	701
Curing Compounds .....	903
Steel Reinforcement .....	905
Structural Steel .....	906
Anchor Bolts and Nuts .....	908
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**Concrete.** Use Grade P1 or S2 concrete for cantilever and truss sign support foundations. Use Grade P2 concrete for all other sign support foundations.

**Structural Steel.** When structural steel is specified for either cantilevers or trusses, use structural steel plants certified by the American Institute of Steel Construction for the Category that applies to Highway Sign Structures.

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**810.03 Construction.** Before beginning any excavations or driving posts, determine the location of all underground utilities in the vicinity as directed in section 107.

Place signs at the bottom height shown on the sign support typical plans or in the contract documents.

Repair zinc coating on sign supports damaged in transporting, handling, or erection according to subsection 716.03.E. All costs associated with this repair work will be borne by the Contractor.

### A. Dimensional Information.

1. **Trusses and Cantilevers.** Fabricate steel cantilevers and steel trusses according to the sign support typical plans and the contract documents.
2. **Steel Column Breakaways and Bridge Connections.** Confirm in the field that breakaway heights, bridge connection strut lengths, and all other dimensions necessary for fabrication are correct, final, and approved in writing by the Engineer before starting fabrication.

### B. Delineators.

1. **Installing Steel Posts.** Drive steel posts plumb into the ground. Do not bend the post or damage the top of the post.
2. **Installing Flexible Delineator Posts.** Install flexible delineator posts, complete with all required anchoring accessories, according to the post manufacturer's directions. Do not bend or damage the posts. Install the flexible post plumb with its reflective sheeting perpendicular (or radial) to oncoming traffic. Replace posts or sheeting damaged during installation. All costs associated with this repair work will be borne by the Contractor.
3. **Reflectors.** Mount reflectors according to Standard Plan R-127 Series. For steel post delineators, use fasteners that hold the reflectors firmly to the post. Use the proper hand or pneumatic blind rivet gun for the solid pin being used. After swaging the collar material into the annular grooves of the pin, form a vandal resistant, locked fastener. Apply the reflective sheeting for the flexible delineator according to the manufacturer's specifications.

**C. Steel Post Sign Supports and Square Tubular Steel Sign Supports.**

Drive or embed the posts so the sign face and supports do not vary from plumb by more than  $\frac{3}{16}$  inch in 3 feet. Provide a center-to-center distance between posts within 2 percent of plan distance.

Do not damage the top of posts when driving.

**D. Wood Post Sign Supports.** Erect wood sign support posts so the sign face and supports do not vary from plumb by more than  $\frac{3}{16}$  inch in 3 feet. For wood post sign supports not requiring pre-drilled holes, place the post ends with the most severe strength defects at the top. Forms will not be required for the concrete, but prevent the intrusion of earth within the limits of the excavation. Tubular shells may be used in soils where the augered hole will not stay open. Provide a center-to-center distance between posts within 3 percent of plan distance.

**E. Installing Steel Posts Through Concrete.** When installing steel sign posts (including square tubular steel sign supports) or steel delineator posts through an existing concrete area, drill or sawcut a separate hole through the concrete for each post. Make this post hole a maximum of 1 inch larger than the largest cross-sectional dimension of the post to be installed. After drilling or sawing, remove all concrete debris from the hole. Clean and dry the area around the hole before proceeding. Insert the galvanized steel post through this hole and into the underlying material to a depth of 3 feet 6 inches measured from the top of concrete grade. Fill the hole around the post with a silicone sealer.

When installing in new concrete, forming the hole before placing the new concrete is permitted.

**F. Installing Wood Posts Through Concrete.** When installing wood sign posts through existing concrete, drill or sawcut a separate hole through the concrete for each post. Make each hole a minimum of 18 inches in diameter. After drilling or sawing, remove all concrete debris from the hole. Clean and dry the area around the hole before proceeding. Center the galvanized steel sleeve and wood post in the hole.

When installing in new concrete, forming the hole before placing the new concrete is permitted.

**G. Sign Band.** Furnish and install bands to fasten a single sign or route marker cluster bracket to the supports according to the sign support typical plans, or as directed by the Engineer.

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### H. **Concrete Glare Screen and Concrete Median Barrier Connections.**

Furnish and install sign supports on concrete glare screen or concrete median barrier according to the sign support typical plans.

I. **Foundations for Steel Column Breakaway Sign Supports.** Auger the holes for supports. Forms will not be required for the concrete, but prevent the intrusion of earth within the limits of the excavation. Tubular shells may be used in soils where the augured hole will not stay open. Place the concrete according to subsection 706.03.H. Hold the stub column in position with a template for a minimum of 24 hours after placement of the concrete. Construct the foundation with the top elevation as shown on the sign support typical plans or in the contract documents.

### J. **Foundations for Cantilever Sign Supports and Truss Sign Supports.**

If the project or section is open to traffic before or during the construction of the foundations, provide and maintain the proper temporary traffic control devices according to section 812, at each foundation until the foundation and backfill are completed and guardrail, if specified, is installed. Construct the foundation with the top elevation as shown on the sign support typical plans or in the contract documents.

1. **Excavation.** Excavate according to subsection 206.03.A.
2. **Forms.** Construct forms according to subsection 706.03.D. Forms may be omitted for footings or portions of foundations that are more than 6 inches below finished earth grade, provided there is no intrusion of earth within the neat lines of the foundation shown on the plans.
3. **Placing Steel Reinforcement.** Place steel reinforcement according to subsection 706.03.E.
4. **Setting Anchor Bolts and Placing Concrete.** Position anchor bolts according to Subsection 810.03.N.1. Place concrete, strike off the seat, and finish smooth and horizontal. Do not erect the cantilever or truss sign support until the concrete has attained 70 percent of the anticipated minimum 28-day compressive strength, or until test beams have attained a flexural strength of 500 psi.
5. **Surface Finish.** Finish exposed surfaces according to section 706.
6. **Curing.** Cure by coating with a white membrane curing compound, except during cold weather protect the concrete according to subsection 706.03.N.

7. **Backfilling.** Secure the Engineer's approval for the backfill material and compaction method before placing backfill. Backfill according to subsection 206.03.B. Place and compact backfill around the foundation in layers not exceeding 9 inches thick

**K. Drilled Piles for Cantilever Foundations.**

1. **Drilled Pile Installation Plan.** Submit an installation plan at the preconstruction meeting for approval by the Engineer. Provide detailed information on all of the following.
  - a. Proposed equipment including cranes, drills, augers, bailing buckets, final cleaning equipment, slurry pumps, tremies or concrete pumps, and casing.
  - b. The overall construction sequence.
  - c. Shaft excavation methods including proposed methods of excavation through and supporting caving soil layers.
  - d. Methods used to mix, circulate and desand slurry, if slurry is to be used.
  - e. Methods used to clean the pile excavation.
  - f. Reinforcement placement including support and centering methods.
  - g. Concrete placement including procedures for free fall, tremie or pumping of concrete.
  - h. Other information shown in the plans or requested by the Engineer.

The Engineer will evaluate the drilled pile installation plan and notify the Contractor, within 7 days after receipt of the plan, of all additional information required and any changes necessary to meet the contract requirements. The Engineer will reject any part of the plan that is unacceptable and the Contractor will resubmit changes for reevaluation. All procedures are subject to trial in the field and the Engineer's approval does not relieve the Contractor from satisfactorily completing the work. The approval by the Engineer will not be cause for extra compensation if the methods of construction or equipment do not provide a satisfactory drilled pile.

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2. **General Methods and Equipment.** Excavate for the drilled pile, to the dimensions and elevations shown on the plans, through whatever materials are encountered. Use methods and equipment suitable for the intended purpose and materials encountered. Secure the Engineer's approval for the general method selected from the following.
  - a. **Dry Construction Method.** Use this method only at sites where the groundwater table is low, seepage is not a problem, and the soil profile is sufficiently stable to support the sides and bottom of the excavation. Drill the excavation, remove accumulated water and loose material from the excavation, and place the drilled pile reinforcing steel and concrete in a dry excavation.
  - b. **Wet Construction Method.** Use this method at sites where a dry excavation cannot be maintained for placement of the concrete. Use water or mineral slurry to maintain stability of caving soils while advancing the excavation to final depth, place the reinforcing cage, and concrete in the drilled excavation. As necessary, desand and clean the slurry; final clean the excavation by means of bailing bucket, air lift, or submersible pump; and place the concrete with a tremie tube or concrete pump beginning at the pile bottom. Provide temporary surface casing to aid drilled pile alignment and position, and to prevent sloughing of the top of the excavation. The Engineer may waive the requirement for a surface casing.
  - c. **Dry Temporary Casing Method.** Use this method where caving soils occur but a relatively dry and stable excavation can be maintained with the use of casing. Install a temporary casing through the caving soils to either the bottom of pile elevation if in dry soil, or to a relatively impermeable strata if ground water is encountered. Remove excess water and soil from within the casing. Advance the casing and excavation simultaneously; however, do not drill outside the casing through caving soil layers. The bottom of the excavation must remain relatively dry and stable long enough to allow placement of the reinforcing steel and concrete. Withdraw the casing while the concrete is in a workable state. Before withdrawing the casing, bring up the level of fresh concrete in the casing so that all fluids behind the casing are displaced upward.

d. **Wet Temporary Casing Method.** Use this method where caving soils occur and a dry excavation cannot be maintained, the soil profile is relatively permeable and the groundwater elevation is above the bottom of pile elevation. Install the casing through the caving soils to the required bottom of pile elevation, then drill the excavation to the required dimensions. Advance the casing and excavation simultaneously, however, do not drill outside the casing through caving soil layers. Maintain a positive pressure differential between the fluid level in the excavation and the groundwater elevation during drilling, excavation and clean out. Place reinforcing steel and either pump or tremie concrete to the bottom of the excavation. Displace water inside the casing with the concrete. Do not pump. This method may involve drilling slurry. Final clean the excavation with a bailing bucket or air lift. Before and during withdrawal of the casing, bring up the level of fresh concrete in the casing so that all fluid trapped behind the casing is displaced upward without contaminating or displacing the shaft concrete.

3. **Casings.** Provide metal casings that are smooth, watertight, and sufficiently strong to withstand handling, installation and the pressure of both concrete and the surrounding earth materials. Provide a casing with inside diameter not less than the size of the pile. Remove all casings from the excavation, except those approved for the permanent casing.

Attach fixtures to aid in the removal of the temporary casing to the top of the casings. Remove temporary casings while the concrete remains workable. Generally, complete concrete placement in the shaft before removing temporary casing. Extract casing slowly, uniformly with the pull in line with the shaft axis. Do not apply eccentric forces that induce undesirable moments in the shaft.

When vibratory extractors are used for casing removal on cantilever foundations requiring two shafts, place both shafts simultaneously and remove the casings while the concrete is in a workable state.

4. **Slurry.** When slurry is employed in the drilling process, submit the slurry properties and construction procedures to the Engineer for approval.

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5. **Excavation Inspection.** Provide equipment for checking the dimensions and alignment of each permanent drilled pile. Determine the dimensions and alignment under the direction of the Engineer by any of the following methods.
  - a. Check the dimensions and alignment of drilled pile excavations using reference stakes and plumb bob.
  - b. Check the dimensions and alignment of casing when inserted in the excavation.
  - c. Insert a casing in pile excavations temporarily.
  - d. Insert a rigid rod assembly with several 90 degrees offsets equal to the pile diameter into the pile excavation.

Reference the depth of the pile during drilling to appropriate marks on the kelly bar. Measure final drilled pile depths with a weighted tape after final cleaning.

Clean each shaft so at least 50 percent of the base has less than  $\frac{1}{2}$  inch of sediment. Do not leave more than  $1\frac{1}{2}$  inches of debris at any point on the base. The Engineer will determine shaft excavation cleanliness by visual inspection for dry excavations, and by other suitable methods for wet excavations.

6. **Concrete Placement.** Place concrete immediately after placing the reinforcing steel. Place concrete continuously to the top elevation of the drilled pile. Continue concrete placement after the excavation is full until good quality concrete is evident at the top of the drilled pile. Place concrete through a tremie tube or concrete pump.

Place concrete and remove temporary casings in less than 2 hours. Adjust the retarding plasticizer in the concrete mix so that concrete remains in a workable plastic state throughout the 2-hour placement limit.

7. **Tremies.** Use a tremie tube with sufficient length to meet the requirements below. Do not use a tremie containing aluminum parts that come in contact with the concrete. Secure the Engineer's approval for the use of pumps. Use pump lines with a minimum 4-inch diameter and watertight joints.

For a dry excavation, use a tremie consisting of a tube of either one piece construction or sections that can be added and removed.



Place concrete through either a hopper at the top of the tube or side opening as the tremie is retrieved. Support the tremie so the free fall of the concrete is less than 5 feet. If concrete placement causes the pile excavation to cave or slough, reduce the height of free fall and/or reduce the rate of concrete flow into the excavation.

For a wet excavation, use a watertight tremie that allows the free flow of concrete and that extends to the bottom of the excavation. Immerse the discharge end in concrete at all times after starting the flow of concrete. Provide a continuous flow of concrete under positive pressure.

**L. Cantilever Sign Supports.** Transport and handle cantilever sign supports without damaging the members. Erect the sign supports according to the following sequence.

1. Place bottom leveling nuts and washers on all the anchor bolts. Place these nuts  $\frac{1}{2}$  inch above the concrete foundation. Bring the nuts level with the highest nut above the foundation. Do not exceed 1 inch of clearance between the concrete foundation and the bottom leveling nuts.
2. Place the upright only, without the arms attached, on the leveled bottom nuts and washers.
3. Apply beeswax or the equivalent to all top nut bearing faces and threads. Place the two top nuts perpendicular and the two top nuts parallel to the sign face (in its final position) on the anchor bolts, along with their corresponding washers, and loosely snug tighten.
4. Level the column base plate by adjusting only the nuts perpendicular and parallel to the sign face (in its final position).
5. Place the remaining top nuts and washers on the anchor bolts and loosely snug tighten.
6. Tighten all bottom nuts and top nuts according to subsection 810.03.N.2.
7. Place the arms, without the sign, on the erected column. Tighten all bolts according to the turn-of-the-nut method (subsection 707.03.D.7.c.) Discard all nuts and bolts loosened or removed after being fully tightened. Previously tightened bolts have been loosened by the tightening of adjacent bolts will not require replacement.

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8. Place the sign panel on the erected arms. Field drill the holes in the aluminum mounting supports which receive the sign panel mounting U-bolts to ensure that the sign panel is horizontal in its final position.
9. Check the anchor bolt nuts connecting the column base to the concrete foundation according to Subsection 810.03.N.2.e. The Engineer must approve field welding.

**M. Truss Sign Supports.** During transportation of truss sign supports, place two 4 by 4 inch wood timbers tightly against each other on the truck bed at each end of the truss section a maximum of 2 inches from the flanges of the truss box. Use a nylon sling to tie each end of the truss box to the truck bed. Tie either the top and bottom or both cords of the truss box to the truck bed. Do not tie any other part of the truss box to another object. Secure the truss and deliver it to the project site.

At the project site, store the truss sign support on a level surface away from traffic. Provide 4 by 4 inch wood timbers at each end and the midspan of each truss sign support section.

Use nylon slings that wrap the entire cross section and provide at least a two-point pickup, for handling the truss, truss sections, and end supports. Do not lift by chains or by internal truss members.

Bring bearing surfaces into full contact in the relaxed position before tightening the flange bolts.

Plumb the end supports using anchor bolt leveling nuts.

The Engineer must approve field welding.

At the time of erection, load the truss to prevent vibration. If the roadway is open to traffic, install only the permanent signs or blank sign panels to accomplish loading. If the roadway is closed to traffic, loading may be accomplished using sandbags. Securely fasten the temporary loads and leave them in place until the permanent signs are installed.

## **N. Anchor Bolts for Cantilever and Truss Sign Supports, Light Standards, CMS Structures and CCTV Poles, Tower Lighting Units and Mast Signal Arm Poles.**

1. **Anchor Bolt Installation.** Use a steel template to place and hold the anchor bolts plumb and in proper alignment. Place the template before placement of the concrete base and leave in place a minimum of 24 hours after concrete has been placed. Leave the support cage, used to position the anchor bolts within the foundation, in the concrete foundation. The Engineer will reject the base for out-of-position anchor bolts and anchor bolts greater than 1:40 out-of-plumb. Do not bend the anchor bolts to straighten or move into position, or alter the base.
2. **Anchor Bolt Tightening.**
  - a. Bring all leveling nuts (bottom nuts) to full bearing on the bottom of the base plate. Keep the bottom of the leveling nuts as close to the concrete base as practical, and not more than one inch above the top of the concrete base. Thread leveling nuts onto the anchor bolt to provide at least  $\frac{1}{4}$  inch projection of the bolt above the top nut when in its tightened position.
  - b. Apply beeswax or equivalent to the top nut bearing face and threads before placing on the anchor bolt. Tighten all top nuts to a snug condition. A snug condition is the tightness attained by the full effort of a person using a wrench with a length equal to 14 times the diameter of the anchor bolt but not less than 18 inches. Apply the full effort as close to the end of the wrench as possible. Pull firmly by leaning back and using entire body weight on the end of the wrench until the nut stops rotating. Use a minimum of two separate passes of tightening. Sequence the tightening in each pass so that the opposite side nut, to the extent possible, will be subsequently tightened until all the nuts in that pass have been snugged.

Check the snug tightness, by a method approved by the Engineer, of both the top and leveling nuts in the presence of Department personnel after completing nut snugging as described above, but before applying a hydraulic wrench. Snugged nuts must meet the following torque.

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Bolt Diameter (in)	Torque (ft-lbs)	
	Min.	Max.
1	100	200
1¼	200	400
1½	300	600
1¾	400	600
2	500	700
2¼	700	900
2½	800	1000

- c. Verify that the top nut and leveling nut are in full bearing on the base plate. If a gap exists between either nut (top or leveling) and the base plate, add a stainless steel Type 304 washer, the same diameter as the hardened washer, and beveled to eliminate the gap between the nut and the base plate. Retighten all nuts according to subsections 810.03.N.2. a and b if beveled washers are added. All costs associated with the removing and re-erecting the structure to install beveled stainless steel washers will be borne by the Contractor.
- d. Using a hydraulic wrench, rotate all top nuts an additional ⅓ turn by tightening all the nuts in two separate passes of equal incremental turns (i.e., ⅙ turn each pass). Use a sequence of nut tightening in each pass so the opposite side nut, to the extent possible, will be subsequently tightened until all the nuts in that pass have been turned. Do not rotate the leveling nut during top nut tightening.
- e. Check the tightness of the nuts in the presence of Department personnel a minimum of 48 hours after the additional ⅓ turn. Apply a torque to the nut according to the following.

Bolt Diameter (in)	Torque (ft-lbs)
	Min.
1	300
1¼	630
1½	1120
1¾	1820
2	2770
2¼	4010
2½	5550

Verify that the bottom leveling nuts are in contact with the base before applying the torque.

Ultrasonically test before erection to verify the absence of flaws. The Department will reject, and require replacement of, the entire base installation if reflectors are found with an indication rating less than 15 decibels. All costs associated with replacing the base installation, if rejected, will be borne by the Contractor.

The Department will ultrasonically test the bolts for acceptance. The Department will also test the nuts and washers for proper tightening. Ultrasonic testing and calibration procedures that will be used by the Department for final acceptance testing are available upon request.

Tighten all nuts or washers that the Department's acceptance procedure find to be loose, according to subsections 810.03.N.2. a through e. The Engineer will determine removal, disassembly, and re-erection of the structure. If nuts require tightening, after the initial installation, all costs required to remove and reinstall nuts and washers and, if necessary, to remove, disassemble, and re-erect the entire structure will be borne by the Contractor.

**O. Bolt Replacement in Retained Bridge Mounted Sign Connections.**

Do not replace bolts in concrete bridge beams and concrete deck fascia. Replace all other bolts connecting the bracket, sign, diaphragm and hanger to the sign connection.

Provide all connection hardware according to subsection 906.06.

Remove all bolts, nuts, flat washers and lock washers used to connect the bolted bridge sign connection bracket to the bridge structure fascia beam, one at a time and replace. Replace these bolts according to subsection 707.03.D.7, including turn-of-nut tightening method according to Table 707-4.

**P. Overhead Lane Assignment Structures.** Construct overhead lane assignment structures according to the sign support typical plans and the traffic signal contract typical construction plans. When foundations, steel poles, and steel cables are in place, erect the overhead lane assignment signs according to the following.

1. Connect two angles to each sign, one on the top and one on the bottom.
2. Assemble the cable clamps, oval eye bolts, threaded rod, nuts, and washers on the top side of each sign.

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3. Hang the signs from the top cable with the bottom plate attached to the lower cable with cable clamps.

**Q. Signs.** All costs associated with repair or replacement of signs as specified by this section will be borne by the Contractor. Provide completed signs reasonably free from defects in materials and workmanship. Provide reflectorized sign faces reasonably smooth and free from dents, wrinkles and other defects. Provide signs with uniform color and brightness over the entire background surface; without mottling, streaks, or stains; and free of warps or other deformations. Signs having an improper font or legend layout must be replaced. Replace signs with unacceptable wrinkles.

A maximum of three patches per sign are allowed. Patch with the same material used to fabricate the sign. Extend patches  $\frac{9}{16}$  inch beyond the outer edges of the defect. The Engineer will determine the maximum patch size. Limit the maximum number of patched signs to 2 percent of the total number fabricated per project. For projects with 100 signs or less, the Engineer will determine the maximum number of signs with patches.

The Engineer will supply date stickers at the preconstruction meeting.

At the time of installation, place a date sticker on the back lower portion of all signs. The date sticker must be fully visible after installation.

Store signs delivered for use on a project according to the sheeting manufacturer's recommendation. Replace or repair all signs damaged, discolored, or defaced during fabrication, transportation, storage, or erection.

Properly position and fasten signs to the support. Tighten bolts in contact with reflective sheeting according to the reflective sheeting manufacturer's recommendations. Nylon washers are considered part of the attaching hardware. Erect all signs clean and free of all substances that would hide or otherwise obscure any portion of the sign face.

Cover the entire message on signs erected along a roadway opened to traffic and having a message not immediately applicable, until the message is applicable. Cover signs according to subsection 812.03.F.2.

On a project or section of a project open to traffic where existing signs are being replaced, remove each sign being replaced when the new sign becomes visible to the motorists. All signs and supports that have

been replaced must be removed from the right-of-way within seven days. Remove according to subsection 810.03.S. Leave all overhead signs in place until the new signs are installed. Retain all existing signs not shown on the plans unless directed otherwise by the Engineer.

Do not install signs behind obstructions. Prune vegetation obstructing signs.

Remove packaging and materials used in protecting sign panels and clean the exposed sign face according to manufacturer's specification. Remove and dispose of all excess material. If sign construction has disturbed the site, level and repair to ensure the effectiveness and neat appearance of the work.

Install signs and supports to the following tolerances.

**Extra Holes.** Maximum two per sign allowed; patch extra holes on both front and back sign surfaces. Use material to patch extra holes of the same reflectivity, color, and age as the reflective sheeting used to fabricate the signs. Apply patches according to the sheeting manufacturer's recommendations.

**Offset.** Erect signs within 2 feet of the location specified but not closer to the edge of the traveled roadway than specified.

**Bottom Height.** Rural  $\pm 6$  inches; Urban + 6 inches, -0 inches.

**Sign Location.** Do not change the location of regulatory, gore and no passing zone signs without the Engineer's approval.

Place advance warning signs  $\pm 10$  feet from the specified location. Place the advance warning signs no less than the minimum distance in the *MMUTCD*.

Place all other signs within  $\pm 20$  feet of the specified location.

**Gaps.** Gaps between plywood sheets must not exceed  $\frac{1}{16}$  inch.

**Wedges.** Limit wedges to  $\frac{3}{4}$  to 1 inch.

**Unacceptable Wrinkles.** Replace signs with any of the following defects.

1. A wrinkle that ends at an outside edge of the sign.
2. A wrinkle that exceeds 3 inches in length.
3. A wrinkle that has split or the sheeting is damaged.

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R. **Installing Department Supplied Sign.** Transport the sign supplied by the Department from a site specified on the plans, to the project site. Notify the Department contact person a minimum of 72 hours before picking up the sign.

S. **Removal of Signs and Sign Supports.** Use the same methods in removing cantilever and truss sign supports as required for erecting the supports. Remove, haul, and stockpile at the specified offsite location, all Type I signs, cantilevers, trusses, column breakaways, bridge connections, and all associated attaching or fastening hardware. Coordinate delivery of these salvaged items with the Department contact a minimum of 72 hours before transporting. Take possession of all remaining signs, supports, and associated attaching or fastening hardware.

Pull sign supports that are to be removed or replaced; do not cut off. If the Engineer determines that posts or columns cannot be pulled, cut them off a minimum of 12 inches below grade and fill the hole.

Remove bridge connections welded to steel beams by flame cutting. Leave a ¼-inch projection from the web. Grind the projection flush to the surface of the web to a maximum surface roughness of 250 micro inches per inch root mean square (rms). Coat the ground surface with an approved zinc-rich primer.

When trusses or cantilevers are removed, separate the truss box or cantilever arms without damage. Remove the truss box or cantilever arms before the end supports. Do not scratch, scorch, or nick the cantilever or truss members.

T. **Removal of Sign Support Foundations.** Remove foundations to 12 inches below the ground surface and backfill according to subsection 204.03.C. If the Engineer requires additional removal, it will be paid for as Removing Masonry and Concrete Structures if the contract contains the item; if the contract does not contain this item, it will be paid for as extra work. Dispose of concrete and other unsuitable material according to subsection 205.03.P. Topsoil, seed, and mulch the removal area according to subsection 816.03.

U. **Erection of Salvaged Sign Supports and Signs.** Use the methods described in subsection 810.03.Q to handle and store signs and sign supports that are salvaged for use on the project. Transport, store, and erect salvaged supports and signs to ensure their condition after completion of the work is the same as before removal.



## 810.04 Measurement and Payment.

Contract Item (Pay Item)	Pay Unit
Delineator Reflector . . . . .	Each
Post, Delineator . . . . .	Each
Post, Flexible, Delineator. . . . .	Each
Delineator, Reflective Sheeting, ___ inch by ___ inch, ( <u>color</u> ) . .	Each
Post, Steel, ___ lb. . . . .	Foot
Post, Wood, ___ inch by ___ inch . . . . .	Foot
Post, Wood, ___ inch by ___ inch, Direct Embedment . . . . .	Foot
Post Hole Through Conc for Wood Post . . . . .	Each
Post Hole Through Conc for Steel Post . . . . .	Each
Band, Sign. . . . .	Each
Glare Screen Connection, Conc . . . . .	Each
Median Barrier Connection, Conc. . . . .	Each
Fdn, Breakaway, W8 by ( <u>wt/ft</u> ). . . . .	Each
Fdn, Cantilever, Type ___ . . . . .	Each
Fdn, Truss, Type ___ . . . . .	Each
Column, Breakaway, W8 by ( <u>wt/ft</u> ). . . . .	Each
Cantilever, Type ___. . . . .	Each
Truss, Type ___, ___ foot . . . . .	Each
Sign, Type ___. . . . .	Square Foot
Bridge Sign Connection, Conc, Type ___. . . . .	Each
Bridge Sign Connection, Steel, Type ___. . . . .	Each
Bridge Sign Connection, Bolt Replacement . . . . .	Each
Overhead Lane Assignment Structure. . . . .	Each
Installing MDOT Supplied Sign, Type ___ . . . . .	Each
Sign, Type ___, Rem . . . . .	Each
Fdn, Wood Support, Rem . . . . .	Each
Fdn, Column Breakaway, Rem . . . . .	Each
Fdn, Cantilever, Rem . . . . .	Each
Fdn, Truss, Rem. . . . .	Each
Cantilever, Rem . . . . .	Each
Truss, Rem. . . . .	Each
Bridge Sign Connection, Type ___, Rem . . . . .	Each
Transporting Salv MDOT Materials . . . . .	Lump Sum
Cantilever, Type ___, Erect, Salv . . . . .	Each
Truss, Type ___, ___ foot, Erect, Salv . . . . .	Each
Sign, Type ___, Erect, Salv . . . . .	Each

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The pay items listed include all costs for furnishing, fabricating and installing the item. Providing dimensional information will be included in the payment for the item being fabricated.

### A. Sign Posts.

1. **Post, Steel** or **Post, Wood** sign supports will be measured to the nearest commercial length required to meet contract requirements. No payment will be allowed for the portion of posts installed to a depth in excess of that required by the plans unless specifically authorized by the Engineer.
2. Square tubular steel sign supports are an acceptable alternate to 3-pound steel posts. The work for square tubular steel sign supports will be measured and paid for at the contract unit price for **Post, Steel, 3 lb**. This includes furnishing the sign post, anchor sleeve, anchor post, associated hardware, and for erecting and installing the post and hardware.
3. Payment for **Post, Wood** includes all costs to furnish and install wood post sign supports of the nominal dimensions specified, set in a sleeve in concrete.
4. Payment for **Post Hole Through Conc for Steel Post** or **Post Hole Through Conc for Wood Post** includes drilling or saw cutting a hole in existing concrete, silicone sealer, cleaning the site, and replacing damaged concrete. When installing in new concrete the optional method of forming, including materials and labor will be included in the item **Post Hole Through Conc for Steel Post** or **Post Hole Through Conc for Wood Post**.

B. Payment for foundations includes all costs for constructing the foundations for sign support including the use of tubular shells. The completed work for construction of drilled piles for cantilever foundations will be measured and paid for at the contract unit price for **Fdn, Cantilever, Type \_\_\_** .

### C. Bridge Sign Connections.

1. Payment for **Bridge Sign Connection** includes locating connections and constructing and installing the sign support.

2. **Bridge Sign Connection, Bolt Replacement** includes all bolted bridge connections, including diaphragms and hangers on steel bridges, which are to be retained. Payment includes all work necessary to remove and replace each bolt and associated hardware. The old bolts and hardware removed become the property of the Department.

D. Payment for **Overhead Lane Assignment Structure** includes all work necessary for the installation of the structures and the lane assignment signs.

E. **Signs.** In determining the area of sign faces, no deduction will be made for corner radii or mounting holes. The computed area will be the smallest circumscribing rectangle except triangular signs will be computed as the area of the circumscribing triangle. The pay item **Sign, Type** \_\_\_ includes all attaching devices and hardware (including H-brackets) and labor to fabricate and erect. Pruning vegetation and site cleanup as specified in subsection 810.03.Q are included in this pay item.

Payment for plywood (Type II) signs includes all costs of the fabricated sign including workmanship, repair, and sealing of plywood edges as stated in subsection 919.02.B.2.

Prior to final acceptance, traffic sign installations which are accepted, approved for use, in use by traffic, and are damaged by other than the Contractor's personnel or equipment, must be replaced or repaired as directed by the Engineer. Replaced items will be paid for at the contract unit price unless the elapsed time between the initial installation and the replacement installation is such that the Contractor can justify a price adjustment according to subsection 103.03. Repaired items will be paid for as extra work.

F. Cost incurred in the certification of structural steel plants are the responsibility of the Contractor/Fabricator and no additional compensation will be allowed. Claims by the Contractor/Fabricator for delays and inconvenience will not be considered.

G. Payment for **Installing MDOT Supplied Sign** includes the labor and equipment necessary for loading the sign at the site specified in the plans, transportation, all sign mounting hardware and installation.

#### H. **Removal of Signs and Foundations.**

1. **Sign, Type** \_\_\_, **Rem** includes the removal of the sign from the support and stacking by shape and size. Payment for **Sign, Type** \_\_\_, **Rem** will also include removal of support(s), sign bands, concrete glare screen connection, or concrete median barrier connection, and

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all attaching or fastening hardware except that removal of cantilever supports, or truss supports will be paid for separately as **Cantilever, Rem** and **Truss, Rem**.

2. If the contract does not include **Bridge Connection, Type \_\_\_ , Rem**, this work will be included in **Sign, Type \_\_\_ , Rem**.
3. Payment for foundation construction or removal items includes top-soil, seeding, and mulch and the work required to restore the area.
  - I. Payment for **Transporting Salv MDOT Materials** includes all labor and equipment necessary for loading, transporting, unloading, and neatly stacking the salvaged materials at the off-site location specified in the plans or as directed by the Engineer.
  - J. Payment for **Cantilever, Erect, Salv** and **Truss, Erect, Salv** includes all labor, materials, and equipment necessary for loading, transporting, unloading, storing, and erecting the salvaged sign support on a new or existing foundation as specified in the plans.
  - K. Payment for **Sign, Erect, Salv** includes all labor, materials, and equipment necessary for storing after removal, loading, transporting, unloading and erecting the salvaged sign on a new sign support, salvaged sign support, or existing sign support as indicated in the plans. The pay item for **Sign, Erect, Salv** includes all attaching devices, hardware (including the brackets), and labor to erect the salvaged sign.