

SUPPLEMENTAL SPECIFICATIONS
INDIANA DEPARTMENT OF TRANSPORTATION
1999 STANDARD SPECIFICATIONS

September 1, 2004

REVISION TO 1999 STANDARD SPECIFICATIONS

SECTION 801, DELETE LINES 1 THROUGH 781.

SECTION 801, AFTER LINE 1, INSERT AS FOLLOWS.

**SECTION 801 – TRAFFIC CONTROLS FOR CONSTRUCTION AND
MAINTENANCE OPERATIONS**

801.01 Description. *This work shall consist of furnishing, placing, and maintaining signs, barricades, temporary pavement markings, and other traffic control devices at construction and maintenance operations in accordance with 105.03.*

MATERIALS

10 **801.02 Materials.** *Materials shall be in accordance with the following:*

	<i>Coarse Aggregate, Class D or Higher, Size No. 73</i>	<i>904</i>
	<i>Construction Warning Lights</i>	<i>913.12</i>
	<i>Delineator Posts</i>	<i>910.15</i>
	<i>Delineators</i>	<i>913.08</i>
	<i>Field Paint</i>	<i>909.04</i>
	<i>Flashing Arrow Sign</i>	<i>913.13</i>
	<i>Flexible Delineator Posts</i>	<i>913.07</i>
	<i>Pavement Marking Materials</i>	<i>913.14</i>
20	<i>Steel Posts</i>	<i>910.14</i>
	<i>Temporary Barrier Delineator</i>	<i>913.08(d)</i>
	<i>Temporary Highway Illumination Materials</i>	<i>807</i>
	<i>Temporary Panel Signs</i>	<i>913.10</i>
	<i>Traffic Signal Materials and Equipment</i>	<i>913.15</i>
	<i>Traffic Signs</i>	<i>802</i>
	<i>Tubular Marker</i>	<i>913.07.1</i>
	<i>Wood Sign Posts</i>	<i>911.02(e)</i>
	<i>Worksite Speed Limit Sign Assembly</i>	<i>913.13.1</i>

30 *Non-ground mounted temporary traffic sign backing material and supports shall both be certified to meet NCHRP 350 crash test standards and approved for use by the FHWA. Roll-up materials will not be allowed. A copy of the FHWA acceptance letter shall be provided the Engineer upon request.*

The background of construction signs shall be reflective sheeting in accordance with 913.10(b)1. The sheeting type used for construction signs shall be the same for the entire project. Reflective sheeting for drums shall be in accordance with 913.10(b)1.

Steel sign posts need not be galvanized.

40

Wood posts for temporary panel signs shall be dense southern yellow pine or design computations shall be provided to the Engineer identifying the type of wood and verifying the location and size of the holes to be drilled through the posts to provide break-away capability.

All temporary traffic control devices which will become the property of the Department shall be a new product at the time of final acceptance.

50 The basis for use for traffic paint; durable pavement marking materials; temporary marking tape type II; glass beads; barrels; barricades; construction warning lights; steel posts; temporary panel signs; traffic signs, except non-ground mounted signs; tubular markers; and wood sign post used for temporary traffic control will be visual inspection.

The connecting bolt or threaded rod used to connect adjoining sections of temporary barrier wall shall have a tensile strength of 827 MPa (120,000 psi). The spacers used between adjoining sections of temporary barrier wall shall be in accordance with ASTM A 36M (ASTM A 36) with a tensile strength of 400 MPa (58,000 psi).

60 **CONSTRUCTION REQUIREMENTS**

70 **801.03 General Requirements.** The applicable requirements of the MUTCD shall apply to the installation and materials for traffic control devices subject to the requirements of 107.08 and 107.12. The Contractor shall be responsible for the field layout, placement, operation, maintenance, and removal of temporary traffic control devices. A worksite traffic supervisor certified by the American Traffic Safety Service Association, ATSSA, or approved equal certifying organization, shall direct all field layout, placement, operation, maintenance, and removal of temporary traffic control devices. The field layout will be reviewed by the Engineer prior to placement of temporary traffic control devices. A copy of the worksite traffic supervisor's certification shall be provided to the Engineer prior to the start of construction of temporary traffic control devices or if the worksite traffic supervisor changes.

Regulatory control devices shall be erected only as directed.

Advisory speeds to be posted will be determined by the Department.

80 The names and telephone numbers of the superintendent and one other responsible employee shall be furnished. Such employees shall be on call or available at night, on weekends, or during other non-working periods to repair or replace all traffic control devices which may become damaged or inoperative.

When traffic lanes are restricted and when specified as a pay item, a patroller shall inspect and maintain traffic control devices. The patroller shall patrol the construction zone and shall immediately correct, maintain, and repair traffic control devices or notify the Contractor designated persons for immediate repair to such traffic control devices. A full time patroller shall be on duty during periods when work is not in progress.

90 *Temporary traffic control devices shall be maintained continuously, except as described herein, to ensure visibility and to protect the public. All reflective sheeting backgrounds and lights shall be kept clean of foreign matter.*

Except for construction warning lights and temporary signals, the ATSSA brochure titled Quality Standards For Work Zone Traffic Control Devices will be used as a guide to determine if temporary traffic control devices are Acceptable, Marginal, or Unacceptable as defined in the brochure. Upon initial setup and phase changes of temporary traffic control devices, all individual devices shall be of the Acceptable classification. A device not completely covered or removed when the message does not
100 *apply or when directed, will be considered unacceptable.*

A temporary traffic control device will be deemed to be in non-compliance when considered Unacceptable. A type of temporary traffic control device will be deemed to be in non-compliance when 25 percent or more of the individual devices are considered Marginal. Damages may be assessed in accordance with 105.14 for non-compliance.

Non-compliance of construction warning lights will be in accordance with
110 *801.14.*

All barricades, signs, or flashing arrow signs shall be moved from one location and re-erected at another location as shown on the plans or as directed.

Where two-way traffic is to be maintained on a one-way pavement, and where the existing shoulders on such roadway are earth, aggregate No. 73 shoulders shall be compacted in accordance with 303.06 as shown on the plans. Compacted aggregate shoulders shall remain in place unless subsequent construction activities on the contract require its removal.

120 *Temporary drainage structures, temporary concrete median barrier units, and other temporary devices required and used for traffic maintenance shall remain the property of the Contractor.*

***801.04 Construction Signs.** Construction signs shall include the typical sign standards or posts which support the sign, all necessary hardware, and specified construction warning lights.*

A route or lane closure notice sign shall consist of a construction sign type A, in accordance with 801.04(a), which indicates route or lane closure. The sign shall be
130 *mounted for a maximum of 14 calendar days and a minimum of seven calendar days before the closure date shown on the sign. The sign shall be removed when the route or lane is closed.*

Trailers in accordance with 910.14(f) may be used as supports for portable construction signs. The trailer shall be located to hold the sign in a proper position. The position of the tongue shall be so as to cause no hazard to traffic. Wheel chocks other

than sandbags shall not be used. The tongue may be pinned to reduce wind-induced rolling if designed to pull up or break from vehicle impact. During nonworking hours, trailers with signs that do not apply to existing conditions shall be stored in accordance with 107.08(c).

Sign posts and their foundations shall be located and constructed to hold signs in a proper position; to resist swaying, turning, or displacement; and minimize the hazard to motorists. No rigidly fixed sign supports will be permitted in exposed areas where it would be practicable to utilize a breakaway or yielding type design. Signs shall be completely covered or removed when the message does not apply.

If the work on a project, or a portion thereof, is not active, and the roadway is open to unrestricted traffic, construction signs may be removed until work resumes. Removal of such signs shall not relieve the Contractor of responsibilities or liabilities described elsewhere herein.

Temporary mounted construction signs shall not be used for operations which affect traffic lanes or paved shoulders. Temporary mounted construction signs shall not be used or left in place during nighttime hours.

(a) Type A. A type A sign shall consist of a construction sign as detailed in the MUTCD or on the standard drawings which is 0.84 m^2 (9 sq ft) or more in area.

(b) Type B. A type B sign shall consist of a construction sign as detailed in the MUTCD or on the standard drawings which is less than 0.84 m^2 (9 sq ft) in area.

(c) Type C. A type C sign shall consist of a construction sign which is not detailed in the MUTCD or on the standard drawings and which is 0.84 m^2 (9 sq ft) or more but less than 3 m^2 (33 sq ft) in area.

(d) Type D. A type D sign shall consist of a construction sign which is not detailed in the MUTCD or on the standard drawings and which is less than 0.84 m^2 (9 sq ft) in area.

(e) Temporary Panel Sign. A temporary panel sign shall consist of a sign fabricated and constructed in accordance with 913.10 and which is greater than 3 m^2 (33 sq ft). Temporary panel signs shall be mounted on wood posts as shown on the plans or as approved by the Department. External bracing shall not be used.

801.05 Detour Route Marker Assembly. Detour route marker assemblies shall be on a single post for a single route or may be on multiple posts for multiple routes. When two routes are being detoured across a common roadway, each route shall be shown by a separate detour route marker assembly. A detour route marker assembly-multiple route shall be used for three or more routes across a common roadway.

801.06 Road Closure Sign Assembly. Road closure sign assemblies shall be used at each road closure location where type III-A barricades or type III-B barricades are used. Road closure sign assemblies shall not be used within lane closures where adjacent lanes remain open to traffic, unless otherwise directed. Road closure sign assemblies may be required at other locations as directed.

190 *Permanent road closure sign assemblies shall be left in place after the contract is completed and shall become the property of the Department. They shall be installed just prior to final acceptance of the contract. Supports shall be painted with white field paint for wood.*

801.07 Barricades. Barricades shall include rails, posts, and all incidentals necessary to complete this part of the work.

200 *High intensity reflective sheeting shall be placed on specified rails of all barricades. The colors for temporary barricades shall be orange and white, and for permanent barricades red and white.*

All type III barricades shall be skid mounted within pavement, shoulder, or sidewalk areas, and on ground mounted posts in all other areas. Type III barricades shall be used on all slopes which are 3:1 or flatter for roadway closures.

(a) Type III-A Barricade. The type III-A barricade shall have rails which are reflectorized on one side and shall be used for roadway closures and lane closures where traffic can approach from only one side.

210 *(b) Type III-B Barricade. Type III-B barricades shall have rails which are reflectorized on both sides and shall be used for roadway closures and lane closures where traffic can approach the barricade from both sides.*

(c) Permanent Type III Barricade. Permanent type III barricades shall be 3.0 m (10 ft) sections and shall be left in place after the contract is completed, and shall become the property of the Department. Permanent type III barricades shall be installed just prior to final acceptance of the contract. All non-reflectorized wood and non-galvanized steel shall be painted with white field paint. Such barricades shall otherwise be in accordance with 801.07(a).

220 **801.08 Cones and Tubular Markers.** Cones shall be made of a material to withstand impact without damage to striking vehicles. They shall have a substantial base to restrict overturning. Cones and tubular markers shall be as shown on the plans.

Cones shall be used only during temporary activities where portability is advantageous and they remain in place and do not create a hazard to traffic. The use of cones in lieu of drums will be permitted during daylight hours unless otherwise directed.

230 *Tubular markers shall be used for separating two-lane two-way traffic as shown on the plans or as directed.*

Cones and tubular markers shall be secured in place either by weighting or adhesives. The use of metal bases will not be permitted.

801.09 Drums. *Drums shall be molded orange polyethylene.*

240 *The shape of the drum shall appear basically cylindrical to the motorist from any direction in any given application. The top outside diameter shall not exceed the bottom outside diameter. Drums shall be multisided, elliptical or have a flattened side to inhibit rolling.*

The top section of the drum shall have at least one construction warning light mounting bracket. The minimum drum height is exclusive of lifting handles or construction warning light mounting brackets.

250 *The drums shall stand on end, be stable against overturning, and shall be internally or externally ballasted to resist wind speeds of up to 80 km/h (50 mph) and gusts created by traffic. The mass (weight) of the ballast shall be 20-25 kg (45-55 lb). The top of the drum shall be free from openings. Internally ballasted and externally collar ballasted drums shall not be mixed in each continuous set-up.*

Internal ballast shall be sandbags, a molded plastic base filled with sand and closed with a locking cover, or a solid rubber base. The internal ballast shall be placed in the lower ¼ of the drum. The ballast device shall be self-draining.

260 *The external ballast shall be two rubber tire base collars. The tire base collars shall have a circumferential contact with the road surface. The maximum diameter of the tire base collar shall not exceed 900 mm (36 in.). The height of two tire base collars at the outside edge shall not exceed 125 mm (5 in.). The rubber ballasting collars shall be clean cut, proper in size, black in color, and not curved up at the edges. The interior and exterior circumference of the collar shall not be slit or cut. Drums which are external collar ballasted shall not be used in situations where the width of the collar interferes with proper placement of the drum. The Department's Guidelines for External Ballast will be used for determining acceptability of rubber tire base collars.*

Upon impact by a vehicle traveling at a speed of 90 km/h (55 mph), the drum and ballast device shall be of a type that permits the body of the drum to separate from the base, thus allowing vehicles to easily pass over the base.

270 *Type III, Class I, reboundable reflective sheeting shall be used to achieve reflectorization. Construction warning lights shall be used in accordance with 801.14 and shall be securely fastened to the mounting brackets. Signs shall not be mounted on drums.*

Permanent drums shall be left in place after the contract is complete, and shall become the property of the Department. They shall be installed just prior to final acceptance of the contract.

801.10 Temporary Concrete Barrier. *Temporary concrete barrier shall be precast in accordance with applicable requirements of 707 and 602. The surfaces of individual precast units shall vary no more than 6 mm (0.25 in.) in 3 m (10 ft) from the specified cross section, as measured from a longitudinal straightedge. The maximum variation in the vertical and horizontal alignment of adjacent units shall be 6 mm (0.25 in.) across the joint, as measured from a 3 m (10 ft) longitudinal straightedge. Sections that have obvious defects or visual cracks shall not be used. Sections that develop any of these conditions during the contract shall be repaired with concrete or replaced within a reasonable amount of time.*

Units precast after March 1, 2003 shall be clearly marked with the name or trademark of the manufacturer, the year of manufacture, and "INDOT". The markings shall be indented on an end or on the top of each barrier section.

(a) Placement. *Temporary concrete barrier shall be located as shown on the plans or as directed. Temporary concrete barrier located along a tapered alignment shall be flared at the rates as shown on the plans for the applicable regulatory speed within the construction zone. If field conditions are such that the required flare rate cannot be utilized, the tapered alignment may be altered, with approval, to a 10:1 flare rate with a 6 m (20 ft) minimum offset from the edge of the through traffic lane to the approaching end of the flared temporary concrete barrier. If field conditions are such that the 10:1 flare rate cannot be utilized, the tapered alignment may be further altered, with approval, to a 6:1 flare rate with the 6 m (20 ft) minimum offset. The use of flare rates sharper than those shown on the plans may require additional traffic control devices as directed.*

(b) Connection. *Temporary concrete barrier sections shall be connected as follows:*

- 1. The adjacent barrier sections shall be placed end to end, with sufficient overlapping of the smooth bar hooks to allow placement of the connecting bolt or threaded rod and the top spacer.*
- 2. The adjacent barrier sections shall then be moved in opposite directions for a sufficient distance to develop the maximum contact between the smooth bar hooks and the connecting bolt or threaded rod.*
- 3. The bottom spacer and nut shall then be placed as shown on the plans. The nut shall be sufficiently tightened to eliminate all gaps between the adjacent bolt heads, spacers, nuts, and washers which form the connection.*

320 *Precast units which have previously been cast meeting earlier Department standards may be used. The Contractor will be allowed to mix units in a run as long as the units are in good condition and the connecting devices are compatible. If units meeting earlier Department standards are used, a 25 mm (1 in.) bolt will be allowed to link the units together. The spacer detail shall, however, be in accordance with the current design. Units cast after March 1, 2003 shall be linked with the 30 mm (1 1/4 in.) bolt.*

330 *(c) Anchorage. Temporary concrete barrier shall be anchored in accordance with the methods shown on the plans, at the locations described herein. Temporary concrete barrier shall be anchored when located on or within 18 m (60 ft) of a bridge, and along tapered alignments. Anchoring at locations in addition to those described herein will be required when directed.*

Chemical anchor systems with removable bolts, or mechanical anchors may be used to anchor temporary concrete barrier to bridge decks, concrete pavement, and concrete shoulders. Mechanical anchors may be ferrous or non-ferrous material. All anchors shall have a shear strength of 44.5 kN (10,000 lb) and an ultimate pullout strength of 29 kN (6,500 lb).

340 *Non-ferrous mechanical anchors shall be installed such that the top end of the sleeve is a minimum of 60 mm (2 1/2 in.) below the final finished concrete surface.*

Ferrous mechanical anchors shall be completely removed when no longer required. All damage to the concrete shall be repaired as directed with no additional payment.

350 *Non-ferrous anchor sleeves and the chemical adhesive component of chemical anchor systems may remain in place when no longer required. The holes remaining in the concrete, after the removal of the bolts used with non-ferrous mechanical anchors and chemical anchor systems, shall be filled with appropriate material as directed, with no additional payment.*

(d) Delineation. Temporary concrete barriers used to separate two-way traffic shall be delineated with top mounted temporary barrier delineators and with side mounted delineators. The top mounted delineators shall be two-sided, shall be yellow, and shall be placed on each section of barrier wall (± 3 m or 10 ft spacing). The top mounted delineators shall be mounted perpendicular to the direction of traffic flow. The side mounted delineators shall be yellow and shall be mounted in accordance with 602.03(f).

360 *Temporary concrete barriers in locations other than separating two-way traffic shall be delineated with either type C construction warning lights or top mounted temporary barrier delineators and with side mounted barrier delineators. The type C lights or the top mounted barrier delineators shall be spaced at the number of meters equal to 0.3 times (number of feet equal to) the number of miles per hour in the posted speed limit with a minimum spacing of 6 m (20 ft). Bi-directional lenses will be required on the warning lights when the barrier is adjacent to a lane that is carrying alternating one way traffic. The color of the barrier delineators shall be white when located on the right side of the traffic lane, and yellow when located on the left side of the traffic lane.*

370 *Where the temporary concrete barrier is located along a tapered alignment and is located behind drums or other reflective delineation devices, the type C construction warning lights and barrier delineators shall not be used.*

801.11 Temporary Crossovers. *Temporary crossovers shall be either type A or type B as shown on the plans and shall be constructed in accordance with the applicable sections of 207, 402, or 502. When required to maintain median drainage, a 375 mm (15 in.) diameter pipe shall be placed at the centerline of the median under the crossover. If the crossover is to remain in place for future construction, the pipe shall have appropriate grated box ends in accordance with 715.*

380 *The pavement structure for the temporary crossover shall be as shown on the plans.*

Traffic control devices, including temporary pavement markings, shall be as shown on the plans. Separation of opposing vehicular traffic between two crossovers shall be as shown on the plans.

390 *Refurbishing of a temporary crossover shall consist of the removal of drums or earth cover from an existing temporary crossover. The temporary crossover shall be patched and resurfaced as directed. Excavated soil resulting from the refurbishing operation, if not used as a part of the contract work, shall become the property of the Contractor. Removed drums will remain the property of the Department.*

After construction is complete, and prior to the opening of all lanes to traffic, the temporary crossover shall be removed or closed.

Where guardrail is required to be removed for construction or refurbishing of crossovers, such removal and subsequent re-erection shall be done as shown on the plans or as directed.

400 *Acceptance of the HMA for temporary crossovers will be in accordance with 402.09.*

801.12 Temporary Pavement Marking. Temporary pavement markings shall be in accordance with 808.04 and 808.05. However, the dashed line pattern used on center line and lane lines may be 1.2 m (4 ft) line segments on 12 m (40 ft) centers. Gore areas shall be marked by outline only and may be 125 mm (5 in.) wide lines. All temporary markings shall be maintained and replaced until they are no longer applicable.

410 Temporary markings placed on the final surface course shall be temporary marking tape type 1.

Where temporary pavement markings are to be placed on a pavement which has existing markings, the existing markings which conflict with the temporary markings shall be removed in accordance with 808.09.

420 When working under traffic, the temporary pavement markings shall be placed before opening the lane to traffic. This shall include, but not be limited to, the marking patterns of gore areas, outside edge line of deceleration and acceleration lanes, narrow bridge markings, lane reduction transitions, lane lines, centerlines, and transverse markings as appropriate.

If a pavement course is to be in place for a period greater than 14 calendar days, all temporary pavement markings shall be placed in accordance with 808.04 and stop lines shall be placed in accordance with 808.05. No-passing zones on all undivided two-way roadways shall be identified with signs and centerline markings.

430 If the temporary pavement markings are to be in service from December 1 through the following March 31, such markings shall be placed in the standard pavement marking pattern and applied prior to the suspension of the work, or within seven work days after the Contractor is directed to place the markings.

The prismatic reflectors shall be removed from snowplowable raised pavement markers which conflict with the temporary traffic marking pattern. Snowplowable raised pavement marker castings damaged by the removal of the reflector shall be replaced in accordance with 808.10. New prismatic reflectors shall be mounted on existing castings in accordance with 808.10 when the final traffic pattern is established.

440 Removal of temporary pavement markings shall be in accordance with 808.09.

(a) Temporary Pavement Marking Methods. Pavement markings shall be installed in accordance with 808.06.

1. Paint. Painted lines on new HMA courses shall require a second application of paint as soon as practical after the first application is dry.

450 **2. Temporary Pavement Marking Tape.** Temporary pavement marking tape shall be applied in accordance with the manufacturer's recommendations. Temporary marking tape shall be new type I or type II material.

All temporary pavement marking tape shall be removed prior to placement of an HMA overlay or final pavement markings.

*a. **Type I.** Type I tape is a removable material. It may be used for longitudinal and transverse markings. It shall be used for longitudinal and transverse markings on the final surface.*

460 *Type I tape shall be removed without the use of solvents, grinding, abrasive blasting, or other methods which may damage the pavement. All visible adhesive residue shall be removed without use of solvents or grinding.*

*b. **Type II.** Type II tape is a non-removable material. It may be used on PCCP to be removed or overlaid with an HMA course greater than 60 kg/m² (110 lb/sq yd). If it is placed on HMA pavement, the tape shall be removed prior to the recycling of the HMA material.*

If it is necessary to remove type II tape, it shall be removed without the use of solvents. All damage to the pavement shall be repaired.

470 ***3. Temporary Raised Pavement Marker.** The temporary raised pavement marker shall be grade 1 or grade 2. When used, it shall be a supplement to other temporary pavement markings. The color of the reflector shall be in accordance with the other temporary pavement marking. The color of the shell of the grade 1 marker shall be in accordance with the color of the other temporary pavement marking.*

Temporary raised pavement markers shall be removed before the next layer of pavement is placed and before the final pavement markings are applied. All damage to the pavement shall be repaired.

480 ***4. Temporary Buzz Strips.** Temporary buzz strips shall be a set of transverse markings. Durable marking material shall be used in accordance with 808.06(b). Temporary buzz strips shall be removed in accordance with 808.09 when no longer required or as directed.*

*(b) **Quality Assurance Unit.** A quality assurance unit for longitudinal line shall be 150 m (500 lft) on marked pavement in any combination or pattern, or portion thereof. A quality assurance unit for transverse marking shall be each. If a marking fails to be in accordance with the marginal standard as defined in the ATSSA Quality Standards for Work Zone Traffic Control Devices, the quality assurance assessment*
490 *will be assessed in accordance with 801.03.*

***801.13 Temporary Illumination.** The temporary highway illumination shall be in accordance with applicable requirements of 807 except as modified herein.*

The electric energy necessary to power the luminaires on a continuous basis is the responsibility of the Contractor.

At completion of the contract work, the temporary illumination shall be removed and shall remain the property of the Contractor. After removal of the temporary illumination equipment, all holes and trenches shall be backfilled with B borrow.

801.14 Construction Warning Lights. Construction warning lights shall be portable, lens directed, enclosed lights that emit an amber color. All warning lights shall be mounted a minimum of 900 mm (36 in.) above the traveled way to the bottom of the lens, unless otherwise directed. Lights not working shall be repaired or replaced immediately. For each day that more than 5% of the required warning lights are not operating, a sum equal to \$4.00 per non-working light will be deducted from the monies due the Contractor.

(a) Type A. Type A lights shall be low intensity flashing warning lights. These lights shall be visible on a clear night from a minimum distance of 900 m (3,000 ft) when there is no external illumination directly on or in the immediate vicinity of the light. They shall operate from dusk to dawn or when conditions exist which tend to obscure vision. Traffic control devices used for maintaining traffic will not require Type A warning lights during unobscured daylight hours.

(b) Type B. Type B lights shall be high intensity, flashing, warning lights. These lights shall be visible on a sunny day from a minimum distance of 300 m (1,000 ft) when viewed without the sun directly on or behind the light.

(c) Type C. Type C lights shall be steady burning warning lights. These lights shall be visible on a clear night from a minimum distance of 900 m (3,000 ft) when there is no external illumination directly on or in the immediate vicinity of the light. They shall operate from dusk to dawn or when conditions exist which tend to obscure vision.

(d) Vehicle Warning Lights. Vehicle warning lights shall be amber and shall be a strobe light or a flashing, oscillating, or rotating directed beam light. They shall be visible to all approaching traffic for a distance of 300 m (1,000 ft).

801.15 Electronic Devices.

(a) Flashing Arrow Sign. Where specified, a flashing arrow sign shall be furnished, installed, and maintained. It shall be operated continuously, when necessary, to divert traffic.

The flashing arrow sign may be of the solar power assisted type only in stationary operations when the horizontal or vertical curvature in the road is such that motorists do not drive into and out of the beam width of the lighted arrow while within sight of the sign.

(b) Changeable Message Signs. This shall consist of furnishing, installing, and maintaining a trailer-mounted, portable sign upon which varying electronically generated messages will be displayed to traffic. The message being relayed to traffic shall be legible and easily understood for a minimum distance of 200 m (650 ft).

A malfunctioning sign shall be repaired or replaced within 24 h.

550 *(c) Temporary Worksite Speed Limit Sign Assembly. This shall consist of furnishing and placing portable speed limit signs as shown on the plans or as directed in areas of work activity. The worksite speed limit flashing strobe lights shall be activated when the worksite speed limit is in effect. This shall be only where and while work is actually in progress, and workers are present. Each strobe light shall be visible through a range of 120 deg when viewed facing the sign and shall have a minimum effective luminance of 2100 cd effective according to the manufacturer's literature, which shall be provided to the Engineer prior to use.*

560 *Wherever a permanent speed limit sign exists within the limits controlled by the worksite speed limit sign assemblies, additional worksite speed limit sign assemblies shall be placed next to the permanent signs.*

The worksite speed limit shall not be used for the entire length of a roadway under construction unless there is actual work activity for the entire length of such roadway. It shall not be activated at the beginning of the day, for the entire day, if actual work is not being done all day in the work area.

570 *The worksite speed zone signage shall be placed and maintained by the Contractor. The worksite speed limit will be 45 mph, or 10 mph below the posted speed limit for the roadway under construction, whichever is lower.*

A worksite "Reduced Speed Ahead" sign shall be placed in advance of the first sign assembly when the reduction in speed limit is greater than 15 mph.

(d) Temporary Traffic Signals. This work shall consist of furnishing, installing, and maintaining temporary traffic signals in accordance with 805 except as modified herein.

580 *Except as shown on the plans, all materials not furnished by the Department shall remain the property of the Contractor after work is completed and the equipment is removed.*

The traffic signal equipment shall be as specified, but may be either new or used. Used equipment shall be in satisfactory working condition and will be approved prior to use.

590 *Two signal heads shall be displayed for each approach. Signals shall be displayed overhead on a span, catenary, and tether utilizing an aircraft cable, unless otherwise directed.*

Electric energy necessary to power the temporary signal is the responsibility of the Contractor. Prior to the start of construction, the schedule of activities shall be coordinated with the power company.

600 *The Contractor shall obtain permits from local officials, companies, or individuals for the use of poles, right-of-way, or other property incidental to the installation of temporary signals. Although entering into the contract implies permission and authority to install conduit under pavement, sidewalks, and alleys, all damage to underground utilities or interruption of such service shall be the responsibility of the Contractor.*

The location, spacing, and timing of signals will be determined by the Engineer.

An IMSA certified level II technician shall be available 24 h a day to respond within 2 h for the maintenance of the traffic signal equipment.

610 *Signal cable may be extended across bridges through conduit which shall be attached to the underside of the coping. Type and spacing of clamps shall be approved prior to installation.*

Conduit shall be steel or plastic. Flexible conduit will be an acceptable alternate for use as ground rod entry, magnetometer, or microloop installations.

The controller shall be solid state digital. When detection is required, the controller shall be traffic actuated solid state, digital.

Vehicle detection, if required, shall be installed as shown on the plans or as otherwise directed and shall be operational prior to signal activation.

620 **801.16 Temporary Traffic Control Zone.** *A temporary traffic control zone is a work zone with frequently changing operation, a maximum duration of seven calendar days; mobile operation; or a temporary traffic stoppage.*

Daytime lane closures on two-lane two-way roads shall be limited in length to a maximum of 1.6 km (1 mi) or the length of one-half a day's operation, whichever is less, or as shown on an approved alternate traffic control plan.

630 **(a) Temporary Traffic Control Signs.** *Temporary traffic control signs (TTCS) are construction signs in a temporary traffic control zone.*

Trailer mounted TTCS shall be positioned such that the tongue and the method of pinning shall minimize the hazard to motorists. Wheel chocks other than sandbags shall not be used. During non-working hours, trailers with signs that do not apply to existing conditions shall be stored in accordance with 107.08.

TTCS shall not be mounted on barricades or other non-approved supports. When the vertical mounting height for TTCS is between 300 mm and 450 mm (12 in. and 18 in.) to the bottom of the sign, tripod supports may be used. When permitted for use, the signs on tripod supports shall be installed so that the angle from vertical does not exceed 30 degrees.

(b) Maintenance of Traffic for Mobile Operations. Signs, flagging, flashing arrow signs, and other required traffic control devices shall be furnished in accordance with the details shown on the plans or as directed. The Engineer reserves the right to stop work at any time to relieve traffic congestion.

(c) Traffic Control for Temporary Traffic Stoppage. Traffic shall not be permitted to pass directly beneath personnel or equipment working on an overhead structure. Traffic stoppage during an overhead operation shall not exceed 20 min at one time. There shall be enough time between consecutive stoppages to permit traffic to return to normal flow.

Three working days prior to commencing work which necessitates temporary stoppage of traffic, written notice shall be given to the Department and the Indiana State Police that highway traffic shall be stopped temporarily at a specific location, time, and date to accomplish specified work. Traffic shall be safely controlled during the stoppage. The following minimum requirements shall be met.

1. On Multi-Lane Divided Highways. Advance warning signs shall be located as specified or as otherwise directed. For each direction of road closure two flaggers shall be located at the site of the work and a minimum of two additional flaggers shall be used to warn approaching traffic.

2. On Non-Divided Highways. Advance warning signs shall be located as specified or as otherwise directed. For each direction of road closure, one flagger shall be located at the site of the work and a minimum of one additional flagger shall be used to warn approaching traffic.

801.17 Method of Measurement. Construction signs, detour route marker assemblies, detour route marker assemblies-multiple routes, temporary worksite speed limit sign assemblies, road closure sign assemblies, temporary changeable message signs, and temporary raised pavement markers will be measured by the number of units installed, maintained, and removed.

Temporary panel signs will be measured by the square meter (square foot). Temporary panel sign supports, when required, will be measured by the meter (linear foot), complete and in place.

Type III-A, type III-B, and permanent type III barricades will be measured by the meter (linear foot) of the width of closure.

Temporary concrete barrier will be measured by the meter (linear foot). Anchored temporary concrete barrier will be measured by the meter (linear foot), separately from unanchored temporary concrete barrier.

690 *Temporary crossovers type A and type B will be measured per each crossover. The refurbishing of temporary crossovers will be measured per each type of crossover refurbished. HMA mixtures for temporary crossovers will be measured by the megagram (ton) in accordance with 109.01(b). Initial resurfacing and initial patching of refurbished crossovers will be measured in accordance with 402.19. Temporary drainage pipe for temporary crossovers will be measured per m (1ft). Seeding and sodding placed due to the construction and removal or refurbishing and closing of temporary crossovers, will be measured in accordance with 621.12. Removal and subsequent replacement of permanent pavement markings and snowplowable raised pavement markers will be measured in accordance with 808.11. Removal and resetting of guardrail, if required for temporary crossovers, will be measured in accordance with 601.12.*

700 *Flashing arrow signs will be measured by the number of calendar days each unit is operated.*

Patroller will be measured by the number of calendar days during the phase or phases of traffic control, as shown on the plans or as otherwise directed, that require the patroller's presence. Each portion of a day will be measured as a whole day.

Temporary pavement markings will be measured by the meter (linear foot) of material actually placed. Temporary buzz strips will be measured by the meter (linear foot) for each strip, without regard to the number of passes required to attain the specified height.

710 *If, due to a Department initiated change or an approved expedited construction schedule, it is necessary to remove temporary nonremovable pavement markings, such removal will be measured in accordance with 808.11. The removal of existing pavement markings which are in conflict with temporary markings, will be measured in accordance with 808.11.*

The removal and replacement of reflectors on existing snowplowable raised pavement markers will be measured in accordance with 808.11.

720 *Compacted aggregate No. 73 used for shoulder material will be measured in accordance with 303.09. Excavation of the existing earth shoulder will not be measured for payment.*

Cones and tubular markers will not be measured for payment. Permanent tubular markers will be measured per each.

Temporary illumination, temporary traffic signals, and maintaining traffic will not be measured for payment.

730 **801.18 Basis of Payment.** *The accepted quantities of construction signs, detour route marker assemblies, detour route marker assemblies-multiple routes, temporary worksite speed limit sign assemblies, road closure sign assemblies, and temporary raised pavement markers will be paid for at the contract unit price per each. Payment for temporary worksite speed limit assemblies and temporary changeable message signs will be made for the maximum number of such assemblies in place during the contract time. Type III-A, type III-B, and permanent type III barricades will be paid for at the contract unit price per meter (linear foot).*

740 *Temporary concrete barrier and anchored temporary concrete barrier will be paid for at the contract unit price per meter (linear foot). Payment will be made only once, regardless of the number of times the barrier is moved to accommodate different phases of traffic maintenance or construction operations as shown in the contract.*

750 *The accepted quantities of temporary crossovers will be paid for at the contract unit price per each for the type specified. The accepted quantities of refurbishing existing temporary crossovers will be paid for at the contract unit price per each for the type specified. The accepted quantities of HMA for temporary crossovers will be paid for as HMA for temporary pavement at the contract unit price per megagram (ton) in accordance with 402.20. Temporary drainage pipe for temporary crossovers will be paid for at the contract unit price per m (lft). Sodding and seeding for temporary crossovers will be paid for in accordance with 621.13. Removal and subsequent replacement of permanent pavement markings and snowplowable raised pavement markers will be paid for in accordance with 808.12. Removal and resetting of guardrail, if required for temporary crossovers, will be paid for in accordance with 601.13.*

If more than one construction sign is mounted on a common support with the messages facing opposite directions, the largest sign will be paid for at the contract unit price of the sign, and each additional sign will be paid for at one half the unit price of the sign if it had been erected independently.

760 *Temporary panel signs will be paid for at the contract unit price per square meter (square foot) as shown on the plans. Temporary panel sign supports will be paid for at the contract unit price per meter (linear foot), complete and in place.*

Flashing arrow signs and patrollers will be paid for at the contract unit price per day per each.

770 *Temporary pavement markings and temporary buzz strips, will be paid for at the contract unit price per meter (linear foot) of material, complete in place, except as set out below.*

Permanent tubular markers will be paid for at the contract unit price per each.

The removal of temporary nonremovable pavement markings caused by a Department initiated change or an approved expedited construction schedule, and the removal of existing pavement markings which are in conflict with temporary markings will be paid for in accordance with 808.12.

Compacted aggregate used for shoulder material will be paid for as compacted aggregate No. 73 in accordance with 303.10.

780

The removal and replacement of reflectors on existing snowplowable raised pavement markers will be paid for in accordance with 808.12.

Temporary illumination will be paid for at the contract lump sum price.

All traffic control devices and construction materials which are specified as separate pay items and used for maintenance of traffic will be paid for as set out in the Schedule of Pay Items.

790

The furnishing, placing, moving, removal, and maintenance of all other traffic control devices will be paid for at the contract lump sum price for maintaining traffic.

The accepted temporary traffic signal, complete in place and later removed as specified, will be paid for at the contract lump sum price.

Payment will be made under:

	Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
	Metric Pay Item	Metric Pay Unit Symbol
800	(English Pay Item)	English Pay Unit Symbol)
	Barricade, _____ type	m (LFT)
	Barricade, III, Permanent	m (LFT)
	Barrier, Direction Indicator	EACH
	Construction Sign, _____ type	EACH
	Detour Route Marker Assembly	EACH
	Detour Route Marker Assembly, Multiple Routes	EACH
810	Drum, Permanent	EACH
	Flashing Arrow Sign	DAY
	Maintaining Traffic	LS
	Patroller	DAY
	Road Closure Sign Assembly	EACH
	Road Closure Sign Assembly, Permanent	EACH
	Temporary Buzz Strips	m (LFT)
	Temporary Changeable Message Sign	EACH
	Temporary Concrete Barrier	m (LFT)
	Temporary Concrete Barrier, Anchored	m (LFT)
820	Temporary Crossover, _____ type	EACH
	Temporary Crossover, _____, Refurbish type	EACH
	Temporary Crossover Drainage Pipe	m (LFT)

	<i>Temporary Illumination</i>	<i>LS</i>
	<i>Temporary Panel Signs</i>	<i>m2 (SFT)</i>
	<i>Temporary Panel Sign Supports</i>	<i>m (LFT)</i>
	<i>Temporary Pavement Marking, _____ mm</i>	<i>m</i>
	<i>width</i>	
830	<i>(Temporary Pavement Marking, _____ in. _____</i>	<i>LFT)</i>
	<i>width</i>	
	<i>Temporary Pavement Marking, Removable, _____ mm</i>	<i>m</i>
	<i>width</i>	
	<i>(Temporary Pavement Marking, Removable, _____ in. _____</i>	<i>LFT)</i>
	<i>width</i>	
	<i>Temporary Pavement Message Marking, _____</i>	<i>EACH</i>
	<i>description</i>	
	<i>Temporary Pavement Message Marking, Removable, _____</i>	<i>EACH</i>
	<i>description</i>	
840	<i>Temporary Raised Pavement Marker, _____</i>	<i>EACH</i>
	<i>grade</i>	
	<i>Temporary Traffic Signal</i>	<i>LS</i>
	<i>Temporary Traffic Signal with Detectors</i>	<i>LS</i>
	<i>Temporary Transverse Pavement Marking, _____ mm</i>	<i>m</i>
	<i>width</i>	
	<i>(Temporary Transverse Pavement Marking, _____ in. _____</i>	<i>LFT)</i>
	<i>width</i>	
	<i>Temporary Transverse Pavement Marking, Removable, _____ mm</i>	<i>m</i>
	<i>width</i>	
850	<i>(Temporary Transverse Pavement Marking, Removable, _____ in. _____</i>	<i>LFT)</i>
	<i>width</i>	
	<i>Temporary Worksite Speed Limit Sign Assembly</i>	<i>EACH</i>
	<i>Tubular Marker, Permanent</i>	<i>EACH</i>

The cost of delineation of temporary concrete barrier shall be included in the cost of temporary concrete barrier.

860 *The costs of installation, maintenance, and removal or closure of the temporary crossover, including excavation, compaction, subgrade preparation, and reshaping damaged median area shall be included in the cost of temporary crossover.*

The cost of the excavation required for placement of compacted aggregate shoulders No. 73 will be included in the pay item maintaining traffic.

The costs of removal of earth cover, removal of drums, reshaping damaged median areas, and closure or removal of temporary crossover shall be included in the cost of temporary crossover, refurbish.

870 *The cost of furnishing, installing, maintaining, and subsequent removal shall be included in the cost of temporary raised pavement marker.*

The cost of cleaning existing pavement and removal of buzz strips shall be included in the cost of buzz strips. Damage to the pavement caused by removal of buzz strips and temporary pavement markings shall be repaired as directed with no additional payment.

880 *No payment will be made for temporary pavement markings which are in the standard pavement marking pattern, and which are to be in service from December 1 through the following March 31 due to the Contractor's failure to complete the work as scheduled. However, payment will be made for these markings should the failure to complete the work as scheduled be due to conditions beyond the Contractor's control.*

The cost of the second application of temporary painted lines on new HMA courses shall be included in the costs of temporary pavement markings.

890 *The cost of furnishing, installing, maintaining, and subsequent removal of the detour marker, route marker, or street or road name sign, cardinal directional marker, directional arrow marker, posts which support the assembly, and all necessary hardware shall be included in the cost of detour route marker assembly or detour route marker assembly, multiple routes.*

The cost of installing, maintaining, and subsequent removal of signs, construction warning lights, assembly supports, and all necessary hardware shall be included in the cost of road closure sign assembly.

The cost of furnishing all materials, erection, maintenance, removal, and necessary incidentals shall be included in the costs of barricades.

900 *Each construction sign, barricade, temporary worksite speed limit sign assembly, temporary changeable message sign, or flashing arrow sign will be paid for only once regardless of how many times each is moved, replaced, or how many times each is altered to change the sign message. Payment will not be made for signs or barricades used for the convenience of the Contractor.*

If a temporary worksite speed limit sign assembly is not flashing when required beginning 2 h after work begins, or if such assembly is flashing when no work has been taking place for 2 h or longer, \$200.00 will be deducted from payment for such work for each 4 h or part thereof, beginning after the 2 h grace period.

910 *If the Contractor elects to use more than two simultaneous operations during the installation of snowplowable pavement markers or reflectors, the costs of required traffic protection devices for additional operations shall be included in the cost of maintaining traffic.*

The cost of necessary flaggers; protection of traffic at structure foundations; and furnishing, erecting, placing, maintaining, relocating, and removing lights, cones, flexible channelizers, tubular markers, drums, delineators, temporary pavement markings, or other devices as directed shall be included in the cost of maintaining traffic.

920

Temporary mounted construction signs will not be paid for.

Replacement of snowplowable raised pavement marker castings damaged due to removing reflectors will not be paid for.

930

The cost of furnishing and placing cones or tubular markers in accordance with 801.08 and drums in accordance with 801.09, the watcher in accordance with 107.12, repair or replacement of damaged or inoperative traffic control devices, and traffic maintenance in accordance with 108.03 shall be included in the cost of maintaining traffic.

If the compacted aggregate size No. 73 required for shoulders is removed, the cost of such removal shall be included in the cost of the compacted aggregate.

Electric energy necessary to power luminaires and temporary traffic signals will not be paid for.

SECTION 802, DELETE LINES 1 THROUGH 234.

SECTION 802, AFTER LINE 235, INSERT AS FOLLOWS:

SECTION 802 – SIGNS

240

802.01 Description. *This work shall consist of furnishing the material for and erecting traffic signs in accordance with 105.03. Signs shall be installed as required unless written approval is obtained from the District Traffic Engineer to make modifications at specific locations.*

Signs shall be stored in such a manner that they do not come in contact with surface run-off water. Signs shall be stored so that moisture accumulation or heat build-up does not occur.

250

All signs shall be marked for identification as shown on the plans. The marking shall consist of a type II sheeting material, with a class I adhesive, shown on the Department's list of approved Sign Sheeting Materials. It shall be applied to the back of the sign on the lower corner closest to the nearest edge of pavement and shall not be covered by the sign's supports.

MATERIALS

802.02 Materials. *Materials shall be in accordance with the following:*

260

<i>Concrete</i>	<i>702 or 913.17</i>
<i>Fasteners.....</i>	<i>913.10(e)</i>
<i>Overhead Sign Structure.....</i>	<i>910.19</i>
<i>Reinforcing Steel.....</i>	<i>910.01</i>
<i>Sign Posts.....</i>	<i>910.14</i>
<i>Traffic Signs</i>	<i>913.10</i>

Materials used for temporary construction signs, temporary traffic signs, and temporary panel signs shall meet the requirements herein. The basis for use of the materials will be by visual inspection with no additional testing, evaluation, or documentation.

CONSTRUCTION REQUIREMENTS

270

802.03 Location of Signs and Sign Structures. *Sign and sign structure locations shall be staked, and the Engineer will either approve the locations or give written notice of necessary changes. The provisions of 109.03 will not apply to posts ordered prior to approval of staked locations.*

Two days notice shall be provided for inspection and approval of staked locations.

280

All signs shall be adjusted to eliminate specular reflection.

802.04 Shop Drawings. *Prior to fabrication, six sets of shop drawings in accordance with 711.05 shall be submitted for all strain poles and structural frames, except breakaway posts. Roadway cross sections and bridge dimensions shall be checked, as applicable, in the field prior to preparation of shop drawings. Notice of all discrepancies shall be provided to the Engineer so necessary design revisions can be made prior to preparation of the shop drawings. If the no-load camber is not shown on the plans, the Contractor shall furnish this camber in the shop drawings.*

290

802.05 Excavation and Backfill. *The finished pavement or shoulder section shall not be damaged during excavation.*

The Engineer shall be notified in writing of class X material in accordance with 206.02 encountered within the limits of the traffic sign supports foundation excavation. The Engineer will determine the design for the installation of the foundations. Excavation of class X material shall be in accordance with 206.

The excavation for sign posts shall be made as nearly as possible to neat lines. Sign post encasement shall not be formed except in sandy soil, or as directed.

300

802.06 Placing Concrete. *Placing concrete shall be in accordance with 702, except that foundations incorporated into sections of concrete barrier wall shall receive a finish in accordance with 702.21. Exposed concrete shall have a smooth surface and beveled edges.*

802.07 Installing Supports.

(a) Posts. *Posts shall be vertical after installation. All damaged posts shall be removed and replaced with an acceptable post.*

310 *Square sign post foundations shall be reinforced anchor base or unreinforced anchor base as shown on the plans. If sign post type A or sign post type B is specified, square sign posts may be used. Splicing of square steel sign posts will not be permitted.*

In locations where class X excavation is encountered, the Engineer will determine the design for the installation of foundations. If the total length of the anchor bolts cannot be used, they shall be cut off. A steel plate measuring 150 by 150 by 13 mm (6 by 6 by 1/2 in.), shall be welded to the bottom of the bolts. The plate shall have a hole cut which allows the bolt to pass through it and the plate and bolt shall be completely welded together around the circumference of the bolt on both sides of the plate. No butt
320 *welding is allowed. The length of the bolts shall allow the plate to be covered by 75 to 100 mm (3 to 4 in.) of concrete at the bottom of the foundation.*

(b) Structural Frames. *When erection of the structure has been started, it shall be completed the same day. The structure shall be loaded, to prevent vibration, by attaching signs or lighting supports the same day.*

An oxidation inhibitor in accordance with 802.07(b)4 shall be applied to all surfaces that mate with a dissimilar material.

330 *Fasteners shall be tightened by turn-of-nut tightening, calibrated wrench tightening, or direct tension indicator tightening. The calibrated wrench shall be calibrated by an acceptable tension measuring device such as a Skidmore-Wilhelm.*

The base plate bolt tightening shall be as follows:

- a. Lower nuts and washers shall be in full contact with the base plate,*
- b. The top nuts shall be tightened to one-sixth turn beyond snug fit,*
- 340 *c. The lower nuts shall be retightened to assure that full contact with the base plate has been maintained.*

Damage that is detrimental to the structural integrity of the frame or aesthetic appearance shall be repaired.

Field welding of aluminum shall be in accordance with 803. Field welding of steel shall be in accordance with 711.32.

350 *The grounding connection shall be located 300 mm (12 in.) from the bottom of the support and shall be easily accessible from the structure manhole.*

Traffic shall be maintained in accordance with 801.16 during installation.

1. Trusses. When placed on blocks to produce the required camber, the truss sections shall fit together at the flange connections with a minimum gap of 1.5 mm (1/16 in.) on any flange assembly. The total of the gaps in any one connection shall not exceed 3 mm (1/8 in.). Gaps shall be shimmed with tapered shims before tightening the flange bolts.

360 All signs and walkway brackets shall be placed as close to the brace points as possible. The Contractor shall verify that the dimensions are suitable for the type of fixture to be supplied.

2. Monotube. The required camber shall be achieved in accordance with the manufacturer's recommendation as detailed on the shop drawings.

3. Cantilever Arms. Cantilever arms shall fit together at the flange connections between sections with a minimum gap of 1.5 mm (1/16 in.) on any flange assembly. The total of the gaps in any one connection shall not exceed 3 mm (1/8 in.).

370 **4. Bridge Brackets.** The location of the sign bracket may be shifted to avoid joints or stiffeners on the bridge. Before placing aluminum in contact with concrete, both the concrete and aluminum surfaces shall be coated with an aluminum-impregnated caulking compound. Where aluminum surfaces are to be placed in contact with steel, the steel surface shall be given one coat of zinc chromate paint and the aluminum surfaces shall be coated with an aluminum-impregnated caulking compound before placement. After the bolts have been tightened, the excess caulking compound shall be removed. All openings around the flanges shall be fully painted and shall be flush with the caulking compound.

380 **802.08 Installing Signs.** If new signs are to be installed on existing structural frames, the existing mounting hardware, if applicable, may be reused. Bolts, nuts, and washers shall not be reused. Additional new hardware may be required to complete the mounting. All such sign hangers protruding above the new signs shall be cut off flush to the top of the signs. Splicing or overlapping of sign hangers will not be permitted. All unused sign hangers and hardware shall be removed.

390 A minimum of two sign support bracket assemblies will be required for all signs having a width greater than 750 mm (30 in.). Signs 2.1 m (7 ft) or less in height shall have sign support bracket assemblies mounted at a maximum spacing of 2.1 m (7 ft). Signs greater than 2.1 m (7 ft) in height shall have sign support bracket assemblies mounted at a maximum spacing of 1.5 m (5 ft). Sign overhang beyond the end bracket assembly shall be not more than half the spacing of the bracket assemblies.

(a) **Sheet Signs.** Sheet signs shall be fastened to the post as shown on the plans. Rivets shall be used to fasten sheet signs mounted to panel or other sheet signs. Steel and plastic washers shall be placed as shown on the plans. Lock-nuts shall be tightened sufficiently so that the sign is held firmly against the post. If the sign sheeting is twisted or damaged, the sign shall be replaced.

400

Lock-nuts for cable span mounted signs shall be tightened so that the sign is held firmly against the cable. There shall be no deformation or twisting of aluminum sheeting, or damage to the reflective sheeting.

(b) Panel Signs. *Panel signs shall be mounted as follows:*

- 1. Up to and including 7300 mm (24 ft) of sign width, clips shall be placed on both sides of each post at the top and bottom of the sign. Intermediate clips shall be placed one on each panel on each post and shall alternate left and right on each post.*
- 2. Over 7300 mm (24 ft) of sign width, double clips shall be used, one on the right side and one on the left side on each post per panel width, plus the sets necessary to attach the top and bottom of the sign.*
- 3. Lock-nuts shall be torqued two full turns beyond snug fit.*

Panels shall be bolted together on 600 mm (24 in.) centers with an allowable gap of no more than 2 mm (1/16 in.) between units. Panels shall be temporarily braced in accordance with the panel manufacturer's recommendations.

802.09 Removal or Relocation of Signs or Support Assemblies. *Signs to be relocated shall be installed in accordance with the MUTCD and on new posts.*

Signs or support assemblies to be removed shall be removed within five work days after the required replacement signs or support assemblies are installed. Concrete foundations shall be removed to a minimum depth of 0.3 m (1 ft) below the ground surface. After concrete foundations have been removed, the area shall be backfilled and seeded or sodded in accordance with 621, or treated with a material which matches that in the surrounding area.

802.10 Roadway and Bridge Reference Signs. *If existing roadway and bridge reference signs interfere with the prosecution of other work, such signs and posts shall be removed, stored, and then reinstalled within 7.5 m (25 ft) of their original longitudinal location or as directed.*

802.11 Method of Measurement. *Sheet signs and panel signs will be measured by the square meter (square foot). Sheet signs will be measured as the smallest dimensions of a square or rectangle large enough to make the sign. However, triangular or trapezoidal signs will be measured as the smallest triangle or trapezoid required to make the sign.*

If the pay unit for sheet signs is shown in the Schedule of Pay Items as each, the number of sheet signs specified, including posts, hardware, and erection, will be measured by the number of units installed.

Sign posts will be measured by the meter (linear foot). Square sign posts will be measured from the top of the post to the termination of the post in the anchor base.

450

Traffic sign support foundations will be measured by the number of units of each type installed. No reduction will be made in a unit if class X material is encountered during foundation excavation.

If class X material is encountered during foundation excavation, the quantity to be measured will be that authorized and removed and in accordance with 206.10.

460 *Structural steel, breakaway, will be measured by the kilogram (pound). Such measurement will include the mass (weight) of breakaway sections such as stubs, stiffeners, base plates, and fuse plates. For rigid sections, the mass (weight) of the base plate will be included.*

Reference posts, including post, sign, and hardware, will be measured by the number of units installed.

Backfill of traffic sign support foundations will be measured in accordance with 211.09.

470 *Overhead sign structures and bridge bracket assemblies will be measured by the number of units of each type installed.*

Overhead sign structures to be removed will be measured by the number of structures removed.

802.12 Basis of Payment. *The accepted quantities of sheet signs and panel signs will be paid for at the contract unit price per square meter (square feet), of the type and thickness specified, with legend, complete in place.*

480 *Sign post will be paid for at the contract unit price per meter (linear foot) for the type specified.*

Structural steel, breakaway, will be paid for at the contract unit price per kilogram (pound).

Ground mounted sign support foundations will be paid for at the contract unit price per each type specified.

490 *Reference posts will be paid for at the contract unit price per each, complete in place.*

Payment for class X material encountered during a foundation excavation, will be made in accordance with 206.11.

Payment for backfill of support foundations will be made in accordance with 211.10.

The removal of signs, overhead structures, and sign assemblies, will be paid for at the contract unit price per each.

500	<i>Metric Pay Item</i> <i>(English Pay Item</i> <i>Pay Item</i>	<i>Metric Pay Unit Symbol</i> <i>English Pay Unit Symbol)</i> <i>Metric Pay Unit Symbol (English Pay Unit Symbol)</i>
	Box Truss Sign Structure Foundation, _____ type	EACH
	Bridge Bracket Assembly	EACH
	Cable Span Sign Structure Foundation, _____ type	EACH
	Cantilever Sign Support Foundation, _____ type	EACH
510	Overhead Balanced Cantilever Sign Structure Foundation, _____ type	EACH
	Overhead Sign Structure, _____, type	EACH
	Overhead Sign Structure, _____, Remove	EACH
	Reference Post.....	EACH
	Sign and Supports, Wide Flange, Remove	EACH
	Sign Post, _____ type	m (LFT)
520	Sign Post, Square, _____, type	Reinforced Anchor Basem (LFT)
	Sign Post, Square, _____, type	Unreinforced Anchor Basem (LFT)
	Sign, Double Faced, Sheet, _____, type	With Legend, _____ thickness
	(Sign, Double Faced, Sheet, _____, type	With Legend, _____ thickness
	Sign, Overhead, Remove	EACH
530	Sign, Panel, With Legend	m2 (SFT)
	Sign, Panel, Relocate.....	EACH
	Sign, Panel, Remove	EACH
	Sign, Sheet Assembly, Relocate.....	EACH
	Sign, Sheet, _____, type	With Legend, _____ thickness
	(Sign, Sheet, _____, type	With Legend, _____ thickness
	Sign, Sheet, and Supports, Remove	EACH
	Sign, Sheet, Relocate.....	EACH
540	Sign, Sheet, Remove	EACH
	Sign, Sheet, With Legend	EACH

Structural Steel, Breakaway..... kg (LBS)
Wide Flange Sign Post Support Foundation, _____ EACH
type

The cost of staking sign and sign structure locations, including materials and labor, shall be included in the cost of the pay items in this section.

550 *The cost of all hardware necessary to assemble and attach the sign to its structural supports, all legend, and adjustments necessary to eliminate specular reflection shall be included in the cost of sheet sign or panel sign.*

The cost of all hardware to attach the sign to its structural supports, the reflective sheeting on both faces, and all legend shall be included in the cost of double-faced sheet signs.

560 *The cost of all necessary hardware including sign hangers, clips, and U bolts required for the mounting of signs to existing or new overhead sign structures shall be included in the cost of the sign.*

The cost of modifying existing hardware to mount a new sign shall be included in the cost of the new sign.

The cost of the reinforced anchor base or unreinforced anchor base, angle bolts, and rivets shall be included in the cost of sign post, square.

The cost of identification markings for signs shall be included in the cost of the sign.

570 *The cost of sign removal, existing post removal, and all mounting hardware necessary to attach the existing sign to new posts, shall be included in the cost of the sign relocation.*

The cost of roadway and bridge reference signs and posts to be removed, stored, and reinstalled shall be included in the cost of other pay items, unless otherwise specified. Roadway and bridge reference signs which are damaged by the Contractor shall be replaced with no additional payment.

580 *The cost of furnishing and applying aluminum-impregnated caulking compound and zinc chromate paint as required in 802.07, shall be included in the cost of the pay items in this section.*

The cost of removal of signs, sign assemblies, sign lighting circuitry, supports, concrete foundations, backfill material, sodding, seeding, and necessary incidentals shall be included in the cost of overhead sign structure, remove.

The replacement of posts damaged by the Contractor's activities shall be without additional payment.

590 *The cost of concrete, reinforcement, stub, anchor bolts, conduit, and all necessary hardware shall be included in the cost of the support foundation.*

The cost of cutting the reinforcing steel and anchor bolts, furnishing the steel plate and welding the plate to the ends of the anchor bolts when class X excavation is encountered shall be included in the cost of the pay items in this section.

No additional payment will be made if square sign posts are used in lieu of type A or type B posts.

600 *The cost of excavation, except for class X material, and necessary incidentals shall be included in the cost of the pay items in this section.*

SECTION 803, DELETE LINES 1 THROUGH 356

SECTION 803, AFTER LINE 357, INSERT AS FOLLOWS:

SECTION 803 – WELDING ALUMINUM ALLOYS

360 ***803.01 Description.*** *This work shall consist of welding aluminum alloys for highway structures. The welding terms used shall be in accordance with definitions included in the AWS Definitions “MD” Welding and Cutting, AWS A3.0. The welding symbols to be used on shop drawings shall be those shown in the Standard Welding Symbols, AWS A2.0. Special conditions shall be fully explained by added notes or details.*

The aluminum alloys to be welded under these specifications may be any of the following ASTM alloy designations:

- 370 1. *wrought non-heat-treatable alloys 3003, 3004, 5052, 5083, 5086, 5456;*
2. *wrought heat-treatable alloys 6061, 6063; or*
3. *cast heat-treatable alloy 356.0.*

803.02 Materials. *Materials shall be in accordance with the following:*

380	<i>Electrodes</i> 910.22
	<i>Filler Material</i> 910.22
	<i>Shielding Gases.....</i> 910.22
	<i>Welding Rods.....</i> 910.22

Material used for permanent backing shall be at least equivalent in weldability to the base metal being welded.

803.03 Welding Processes. *The welding process shall be by the gas metal-arc process or the gas tungsten-arc process. Other processes may be used if prior approval is given.*

390

(a) Preparation of Materials. Joint details shall be in accordance with design requirements and detail drawings. The location of joints shall not be changed without approval.

Edge preparation shall be by sawing, machining, clipping, or shearing. Gas tungsten-arc or gas metal-arc cutting may also be used. Cut surfaces shall meet the ANSI surface roughness rating value of 1000. Oxygen cutting shall not be used.

400 *Surfaces and edges to be welded shall be free from fins, tears, and other defects which would adversely affect the quality of the weld. Dirt, grease, forming or machining lubricants, and organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing.*

The oxide shall be removed from all edges and surfaces to be welded by wire brushing or by other mechanical methods such as rubbing with steel wool or abrasive cloth, scraping, filing, rotary planing, or sanding just prior to welding. If wire brushing is used, the brushes shall be made of stainless steel. Hand or power driven wire brushes which have been used on other materials shall not be used. Where mechanical methods of oxide removal are found to be inadequate, a standard chemical method shall be used.
410 *Welding shall be done within 24 h after chemical treatment. When gas tungsten-arc welding with direct current straight-polarity is being used, all edges and surfaces to be welded shall have the oxide removed by a standard chemical method.*

Welding shall not be done on anodically treated aluminum unless the condition is removed from the joint area to be welded.

(b) Welding Procedure. All butt welds requiring 100% penetration, except those produced with the aid of backing, shall have the root of the initial weld chipped or machined out to sound metal before welding is started from the second side. Butt
420 *welds made with the use of backing shall have the weld metal fused with the backing. Where accessible, backing for welds that are subject to computed stress or which are exposed to view on the completed structure and which are not otherwise parts of the structure, shall be removed and the joints ground or machined smooth. In tubular members, butt welds subjected to computed stresses shall be made with the aid of permanent backing rings or strips.*

The procedure used for production welding of any particular joint shall be the same as used in the procedure qualification for that joint.

430 *All welding operations, either shop or field, shall be protected from air currents or drafts so as to prevent any loss of gas shielding during welding. Adequate gas shielding shall be provided to protect the molten metal during solidification. The work shall be positioned for flat position welding whenever practicable. All weld joints shall be dry at the time of welding.*

The size of the electrode, voltage and amperage, welding speed, gas or gas mixture, and gas flow rate shall be suitable for the thickness of the material, design of joint, welding position, and other circumstances attending the work. Gas metal-arc welding shall be done with direct current, reverse polarity. Gas tungsten-arc welding shall be done with alternating current or with direct current, straight polarity.

When the joint to be welded requires specific root penetration, the Contractor shall make a sample joint and a macro etched cross section of the weld to demonstrate that the joint welding procedure to be used is attaining the required root penetration. The sample joint shall have a length of at least 0.3 m (1 ft) and shall be welded with the electrode, polarity, amperage, voltage, speed, gas mixture, and gas flow rate that are proposed to be used in production welding. Evidence on record may be accepted in lieu of the preceding test.

Where preheat is needed, the temperature of preheat shall not exceed 177°C (350°F) for heat-treated alloys and 316°C (600°F) for non-heat-treated alloys. The temperature shall be measured by temperature indicating crayons or by pyrometric equipment. Heat-treated alloys shall not be held at the maximum preheat temperature or at temperatures near the maximum for more than 30 min.

(c) Weld Quality. Welds will not be accepted if they contain cracks in the welds or in the adjacent base metal, copper inclusions, or porosity in excess of that permitted by Appendix IV, Section VIII, of the ASME Boiler and Pressure Vessel Code.

Lack of fusion, incomplete penetration, or tungsten or oxide inclusions will be acceptable only if small and well dispersed.

Undercut shall be no more than 0.3 mm (0.01 in.) deep when its direction is transverse to the primary stress in the part that is undercut. Undercut shall be no more than 0.8 mm (1/32 in.) deep when its direction is parallel to the primary stress in the part that is undercut. Overlap shall not be allowed. All craters shall be filled to the full cross section of the welds. Welds having defects greater than the levels of acceptance specified herein shall be considered as rejected unless corrected in accordance with 803.02(e).

(d) Inspection. All welds shall be inspected visually to determine compliance with 803.02(c). In addition, all welds subjected to computed stress shall be inspected by the dye penetrant method except as specified below. For highway sign structures, the dye penetrant method shall be used on butt welds in columns and main chord members; on fillet welds connecting columns to bases and main chord members, including the associated flanges, gussets, or main load carrying brackets or members; and on fillet welds connecting flanges to the main truss chord members. The dye penetrant tests shall be performed in accordance with ASTM E 165, method B, procedures B-2 or B-3.

Dye penetrant inspection may be omitted provided that the inspector examines each layer of weld metal with a magnifier of 3X minimum before the next successive layer is deposited.

(e) Corrections. In lieu of rejection of an entire piece or member containing welding which is unacceptable, the corrective measures listed below may be permitted if approval is obtained prior to making each repair. Defective welds shall be corrected by removing and replacing the entire weld, or as follows:

490 1. **Cracks in Welds or Base Metal.** Determine the full extent of cracks by dye penetrant method or other positive means. Remove the cracks throughout their length and depth, and reweld.

 2. **Excessive Porosity and Lack of Fusion.** All defective portions are to be removed and rewelded.

 3. **Copper or Tungsten Inclusions.** All defective portions are to be removed and rewelded.

500 4. **Excessive Concavity of Crater, Undercut and Undersize Weld.** The weld shall be cleaned and additional weld metal shall be deposited.

 5. **Overlap.** Overlap shall be reduced by removal of the excess weld metal.

 The defective areas shall be removed by chipping or machining. Oxygen cutting shall not be used. Before rewelding, the joint shall be inspected to ensure all the defective weld has been removed. If dye penetrant has been used to inspect the weld, all traces of penetrant solutions shall be removed with solvent, water, heat, or other suitable means before rewelding.

510

803.04 Qualification of Procedures, Welders, and Welding Operators. Joint welding procedures shall be qualified previously by tests prescribed in Part B, Section IX, of the ASME Boiler and Pressure Vessel Code. Evidence of previous qualification of the joint welding procedures to be employed may be accepted.

520 All welders and welding operators shall be previously qualified by tests in accordance with Part B, Section IX, of the ASME Boiler and Pressure Vessel Code. Evidence of previous qualification of the welders and welding operators to be employed may be accepted. The same process and type of equipment that is required for execution of the contract work shall be used in qualifying welders and welding operators.

SECTION 804, DELETE LINES 1 THROUGH 65.

SECTION 804, AFTER LINE 66, INSERT AS FOLLOWS:

SECTION 804 – DELINEATORS

70 **804.01 Description.** This work shall consist of furnishing and erecting delineators in accordance with 105.03 and 107.12. Delineators shall be installed as required unless approval is obtained from the District Traffic Engineer to make modifications.

MATERIALS

804.02 Materials. *Materials shall be in accordance with the following:*

<i>Delineator Posts</i>	<i>910.15</i>
<i>Flexible Delineator Posts</i>	<i>913.07</i>
<i>Delineators</i>	<i>913.08</i>

80

The types of delineators shall be:

(a) D1 - single;

(b) D2 - double;

(c) D3 - triple.

90

Hardware for mounting delineators on posts shall be aluminum alloy in accordance with 913.10(e)2; stainless steel or galvanized steel in accordance with 913.10(e)1; or aluminum pull-through blind rivets. Bolts and lock-nuts or rivets shall be 4.8 mm (3/16 in.) diameter.

CONSTRUCTION REQUIREMENTS

100

804.03 Delineator Visibility. *Delineator reflector units shall be positioned so as to be visible for a distance of 300 m (1000 ft) on tangent sections or at maximum visibility distances on curves. These locations shall be established under normal weather and atmospheric conditions when illuminated by the upper beam of standard automobile headlights.*

804.04 Posts. *Posts shall be installed in accordance with 802.07.*

804.05 Flexible Delineator Posts. *These posts shall be installed according to the manufacturer's recommendations and shall be set so that the top is no more than 13 mm (1/2 in.) from any vertical plane through the bottom.*

110

804.06 Method of Measurement. *Delineators with posts, delineator posts, and flexible delineator posts will be measured by the number of units of the type specified.*

804.07 Basis of Payment. *The accepted quantities of delineators, delineators with post, delineator post, and flexible delineator post, if set out as a separate pay item, will be paid for at the contract unit price per each for the type specified, complete in place.*

Payment will be made under:

120

<i>Pay Item</i>	<i>Pay Unit Symbol</i>
<i>Delineator</i>	<i>EACH</i>
<i>Delineator Post</i>	<i>EACH</i>
<i>Delineator Post, Flexible</i>	<i>EACH</i>
<i>Delineator with Post, _____</i> <i>type</i>	<i>EACH</i>

Where new delineator posts are installed to replace existing delineator posts, the cost of the removal of the existing post shall be included in the cost of the new post.

SECTION 805, DELETE LINE 12.

SECTION 805, AFTER LINE 13, INSERT AS FOLLOWS:

Coarse Aggregate, Class E or Higher, Size No. 8.....904

SECTION 805, BEGIN LINE 245 DELETE AND INSERT AS FOLLOWS:

A minimum of 300 mm (12 in.) and a maximum of 450 mm (18 in.) of loop wire duct will be permitted in the detector housing for each loop lead. ~~High-early-strength concrete~~ *Concrete in accordance with 305.06(a) shall be used in the installation of detector housings shall be in accordance with 506*, except where a portion of the road is closed or where there is no vehicular traffic, then class A concrete *in accordance with 702* may be used. The concrete shall be placed flush with existing surface and shall be covered with a steel plate during the setting time.

SECTION 805, BEGIN LINE 258, DELETE AND INSERT AS FOLLOWS:

Loop wire shall be in accordance with ~~913.15(f)4e(2)~~ *913.15(f)5g(2)*. Loop detector sealant shall be in accordance with ~~913.15(f)4e(3)~~ *913.15(f)5g(3)*.

SECTION 806, LINE 1, DELETE AND INSERT AS FOLLOWS:

SECTION 806 – TEMPORARY TRAFFIC SIGNALS *BLANK*

SECTION 806, DELETE LINES 2 THROUGH 144.

SECTION 807, DELETE LINE 19.

SECTION 807, AFTER LINE 20, INSERT AS FOLLOWS:

Coarse Aggregate, Class D or Higher, Size No. 53.....904

SECTION 807, AFTER LINE 37, INSERT AS FOLLOWS:

Reinforcing steel shall be epoxy coated.

SECTION 807, BEGIN LINE 318, DELETE AND INSERT AS FOLLOWS: [807.10(a)] permanently. If the liner is left in place, all voids between the excavation walls and the form shall be filled and compacted using *coarse aggregate* size No. 53 ~~aggregate~~. If the liner is withdrawn, the top 300 mm (12 in.) of the foundation shall remain formed until the concrete has obtained initial set.

SECTION 807, BEGIN LINE 325, DELETE AND INSERT AS FOLLOWS: [807.10(b)]
mounting for the lighting standard after installation. The grounding coil, as shown on
the plans, may be used for grounding lighting standards set on precast foundations.
Foundation backfill shall consist of ~~compacted~~ *coarse aggregate* size No. 53 aggregate.

SECTION 807, AFTER LINE 346, INSERT AS FOLLOWS:

*The base plate shall be designed to carry the pole assembly. The plate assembly
shall be supported by a transformer base, which shall be in accordance with the
breakaway requirements in the AASHTO Standard Specifications for Structure Supports
for Highway Signs, Luminaries, and Traffic Signals.*

SECTION 807, BEGIN LINE 746, INSERT AS FOLLOWS:

installation shall be included in the cost of light pole, high mast. The costs of excavation,
concrete, sleeves for cable duct, *non-metal pipe*, reinforcing steel, backfill, finish grading,
and sodding
shall be included in the cost of lighting foundation.

SECTION 808, BEGIN LINE 13, DELETE AND INSERT AS FOLLOWS:

Cones.....~~801.07~~ 801.08

SECTION 808, AFTER LINE 143, INSERT AS FOLLOWS:

*Painted markings on newly constructed surfaces shall receive two applications of
paint and glass beads. The second application shall be applied as soon as practical after
the first application dries.*

SECTION 808, BEGIN LINE 244, DELETE AND INSERT AS FOLLOWS:

control devices, safety devices and proper procedures. Traffic control devices shall be
placed in accordance with ~~107.11~~ 107.12. Flaggers shall be provided for traffic control as
directed.

SECTION 808, BEGIN LINE 256, DELETE AND INSERT AS FOLLOWS:

(b) Vehicle Warning Lights. All amber flashing warning lights and amber
strobe lights mounted on vehicles used in the marking operation shall be in accordance
with ~~801.06~~ 801.14(d). All vehicles used in the marking operation shall have a
minimum of one

SECTION 808, BEGIN LINE 433, DELETE AND INSERT AS FOLLOWS:

(linear foot) along the front face of the curb. The "No Parking Any Time" sign will be
measured in accordance with ~~802.40~~ 11. Pavement message markings will be measured by

SECTION 808, BEGIN LINE 472, DELETE AND INSERT AS FOLLOWS:

for curb painting, of the color specified. The "No Parking Any Time" sign will be paid
for in accordance with ~~802.41~~ 12. Pavement message markings placed will be paid for at
the

SECTION 808, AFTER LINE 510, INSERT AS FOLLOWS:

*No additional payment will be made for the second application of traffic paint
and glass beads as required in 808.06(a)1.*