

**DIVISION 700. WORK ZONE TRAFFIC CONTROL AND PROTECTION, SIGNING, AND PAVEMENT MARKING**

**SECTION 701. WORK ZONE TRAFFIC CONTROL AND PROTECTION**

**701.01 Description.** This work shall consist of the furnishing, installation, maintenance, relocation, and removal of work zone traffic control and protection.

**701.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Sign Posts, Metal (Note 1) .....	1093.01(a)
(b) Sign Posts, Wood (Note 2) .....	1007.05
(c) Pavement Marking Tape .....	1095.06

Note 1. Galvanizing of metal posts will not be required.

Note 2. The nominal size of wood posts shall be 4 x 4 in. (100 x 100 mm).

**CONSTRUCTION REQUIREMENTS**

**701.03 Equipment.** Equipment shall be according to the following.

Item	Article/Section
(a) Signs .....	1106.01
(b) Flagger Traffic Control Paddle .....	1106.01
(c) Lights .....	1106.02
(d) Cones .....	1106.02
(e) Type I, II, and III Barricades .....	1106.02
(f) Vertical Barricades .....	1106.02
(g) Vertical Panels .....	1106.02
(h) Direction Indicator Barricades .....	1106.02
(i) Drums .....	1106.02
(j) Flexible Delineators .....	1106.02
(k) Truck Mounted Attenuators .....	1106.02
(l) Arrow Boards .....	1106.02
(m) Portable Changeable Message Signs .....	1106.02
(n) Sign Trailers .....	1106.02
(o) Temporary Rumble Strips .....	1106.03

**701.04 General.** Work zone traffic control and protection shall be according to the traffic control plan and the MUTCD.

The traffic control shown on the plans represents the minimum required combination of traffic control devices needed for a particular construction operation. Conditions created by the Contractor's operation which are not covered by the plans shall be delineated by devices as directed by the Engineer at no additional cost to the Department. Revisions or modifications of the traffic control shall have the Engineer's written approval.

Traffic control shall be installed sequentially in the direction of the traffic flow and removed in reverse order. Advance warning signs shall be erected prior to channelizing devices and shall remain until all devices have been removed from the pavement.

The traffic control shall remain in place only as long as needed and shall be removed when directed by the Engineer. Signs that do not apply to current conditions shall be removed, covered, or turned from the view of motorists. All existing pavement markings which conflict with the revised traffic pattern shall be removed according to Section 783.

At the preconstruction conference, the Contractor shall furnish the name and telephone number of the individual in the Contractor's direct employ who is to be responsible, 24 hours-a-day, for the installation and maintenance of traffic control for the project. When the actual installation and maintenance are to be accomplished by a subcontractor, consent shall be requested of the Engineer at the time of the preconstruction conference. This shall not relieve the Contractor of furnishing a responsible individual in the Contractor's direct employ. The Department will provide the Contractor with the name of its representative who will be responsible for administration of the traffic control.

**701.05 Maximum Length of Lane Closure.** The maximum length of lane closure on multilane highways shall not exceed one day's production or 3 miles (5 km), whichever is less, except lane closures up to 5 miles (8 km) in length will be permitted for portland cement concrete patching and continuously reinforced concrete patching operations. Gaps between successive lane closures shall not be less than 2 miles (3 km) in length.

**701.06 Minimum Lane Width.** The minimum lane width adjacent to a closed lane during paving, patching, and other moving operations on freeways and expressways shall be a minimum of 10 ft (3 m). The 10 ft (3 m) shall be clear, unobstructed, and free of channelizing devices or other obstacles.

**701.07 Drop-offs.** The maximum allowable differential in elevation between adjacent open traffic lanes shall be 2 in. (50 mm).

When HMA resurfacing is being constructed and the road is opened to traffic, there shall be no more than 4 lane miles (6.5 lane km) of new binder or surface adjacent to the shoulder without either completing the shoulders, providing barricades or vertical panels, erecting "LOW SHOULDER" signs at 2 mile (3 km) intervals, or constructing a temporary earth wedge against the edge of pavement and compacting it to the satisfaction of the Engineer.

At locations where construction operations result in a differential in elevation exceeding 3 in. (75 mm) between the edge of pavement or edge of shoulder within 3 ft (900 mm) of the edge of the pavement and the earth or aggregate shoulders, Type I or II barricades or vertical panels shall be placed at 200 ft (60 m) centers on roadways where the posted speed limit is 45 mph or greater and at 100 ft (30 m) centers on roadways where the posted speed limit is less than 45 mph.

Where construction operations result in a temporary drop-off at the edge of a completed stabilized shoulder and the road has a posted speed limit of 55 mph or

greater and is open to traffic, "SHOULDER DROP-OFF" (W21-I103) signs shall be used. The Contractor shall place the signs at the beginning of the drop-off area, just beyond freeway interchanges or major intersections on non-freeways, and at such other locations within the drop-off area as the Engineer may direct to ensure a nominal spacing of 2 miles (3 km). The signs shall be placed just prior to the work which will result in the drop-off and shall remain in place until the drop-off is eliminated.

**701.08 Contractor's Operations and Equipment.** The Contractor shall keep all equipment, material, and vehicles off the pavement and shoulders on the side of the pavement which is open to traffic. Except where controlled by flaggers, the Contractor shall operate vehicles and equipment in the direction of traffic while traveling and working on the pavement and shoulders of a two-lane two-way highway. On a multilane highway, the Contractor shall operate vehicles and equipment in the direction of traffic while traveling and working on the pavement and shoulders.

Excavation for construction on both sides of the pavement at any one location at the same time will not be permitted. At any location on existing pavements less than three lanes in width, the sequence of construction shall limit operations to one side of the pavement.

**701.09 Use of Median Crossovers.** The Contractor will be permitted to make "U" turns across the median at existing maintenance crossovers or crossovers constructed by the Contractor, provided the width of the crossover is adequate to ensure no disruption of traffic on the through lanes and at locations permitted by the Engineer. The use of median crossovers will not be permitted within 1320 ft (400 m) of the speed change taper of an interchange ramp, within 2000 ft (600 m) of the taper for a lane closure, or when the construction traffic will be entering or exiting the only open lane within a construction zone. Crossovers shall also conform to minimum sight distance requirements.

While the crossover is being used, two signs shall be placed in the median and two signs shall be placed opposite on the outside shoulder of the highway in advance of the crossover on the side where trucks enter the highway. The first pair, approximately 1000 ft (300 m) from the crossover, shall be 48 in. (1.2 m) "MERGE RIGHT" signs. The second pair, approximately 1500 ft (450 m) from the crossover, shall be 48 in. (1.2 m) "TRUCKS ENTERING ON LEFT" signs. The warning signs in advance of the crossover in the other direction shall be as listed above, except the second pair shall be "TRUCKS LEAVING ON LEFT".

**701.10 Surveillance.** When open holes, broken pavement, trenches over 3 in. (75 mm) deep and 4 in. (100 mm) wide or other hazards are present adjacent to an open lane, in a closed lane, or adjacent to the closed lane, the Contractor shall furnish traffic control surveillance during all hours when the Contractor is not engaged in construction operations. The surveillance person(s) shall be provided with adequate transportation and communications to ensure deficiencies can be corrected. The surveillance person(s) shall drive over and inspect the work, maintain the temporary traffic control devices, and assist and direct traffic, at such intervals as may be required, not to exceed four hours. The person responsible for surveillance shall complete an inspection form, furnished by the Engineer, on a daily basis. The completed form shall be given to the Engineer on the first working day after the inspection.

**701.11 Equipment Parking and Storage.** During working hours, all vehicles and/or nonoperating equipment which are parked, two hours or less, shall be parked at least 8 ft (2.5 m) from the open traffic lane. For other periods of time during working and for all nonworking hours, all vehicles, materials, and equipment shall be parked or stored a minimum of 30 ft (9 m) from the pavement when the project has adequate right-of-way. When adequate right-of-way does not exist, vehicles and materials shall be located at least 15 ft (4.5 m) from the edge of any pavement open to traffic, unless located behind temporary concrete barrier, temporary bridge rail, or other man-made or natural barriers. Temporary barriers erected for protection by the Contractor shall meet the approval of the Engineer.

Any unattended obstacle or excavation (not patching) in the work area which constitutes a hazard in the opinion of the Engineer, shall be delineated by devices at 50 ft (15 m) centers. If the hazard exceeds 250 ft (75 m) in length, the spacing of devices may be increased to 100 ft (30 m).

When not being utilized to inform and direct traffic, sign trailers, arrow boards, and portable changeable message boards shall be treated as nonoperating equipment.

**701.12 Personal Protective Equipment.** All personnel, excluding flaggers, working outside of a vehicle (car or truck) within 25 ft (7.6 m) of pavement open to traffic shall wear a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 2 garments. Other types of garments may be substituted for the vest as long as the garments have a manufacturer's tag identifying them as meeting the ANSI Class 2 requirement.

**701.13 Flaggers.** All flaggers shall be certified by an agency approved by the Department. While on the job site, each flagger shall have in his/her possession a current driver's license and a current flagger certification I.D. meeting Department requirements. For non-drivers, the Illinois Identification Card issued by the Secretary of State will meet the requirement for a current driver's license. This flagger certification requirement may be waived by the Engineer for emergency situations that arise due to actions beyond the Contractor's control where flagging is needed to maintain safe traffic control on a temporary basis.

The signaling methods used by flaggers shall comply with those contained in the Department's "Flagger Handbook".

Flaggers shall be stationed to the satisfaction of the Engineer and be equipped with a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 2 garments and flagger traffic control paddles. The longitudinal placement of the flagger may be increased up to 100 ft (30 m) from that shown on the plans to improve the visibility of the flagger. Flaggers shall not encroach on the open lane of traffic unless traffic has been stopped.

For nighttime flagging, flaggers shall be illuminated by an overhead light source providing a minimum vertical illuminance of 10 fc (108 lux) measured 1 ft (300 mm) out from the flagger's chest. The bottom of any luminaire shall be a minimum of 10 ft

(3 m) above the pavement. Luminaire(s) shall be shielded to minimize glare to approaching traffic and trespass light to adjoining properties.

Nighttime flaggers shall be equipped with a fluorescent orange or fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 3 garments.

Flaggers shall be provided per the traffic control plan and as follows.

- (a) Two Lane Highways. Two flaggers will be required for each separate operation where two-way traffic is maintained over one lane of pavement. Work operations controlled by flaggers shall be no more than 1 mile (1600 m) in length. Flaggers shall be in sight of each other or in direct communication at all times. Direct communication shall be obtained by using portable two-way radios or walkie-talkies.

An additional flagger will be required at each side road within the operation where two-way traffic is maintained on one lane of pavement.

- (b) Multilane Highways. At all times where traffic is restricted to less than the normal number of lanes on a multilane pavement with a posted speed limit greater than 40 mph and the workers are present, but not separated from the traffic by physical barriers, a flagger shall be furnished to support the workers and to warn and direct traffic. One flagger will be required for each separate activity of an operation that requires frequent encroachment in a lane open to traffic.

Flaggers will not be required when no work is being performed, unless there is a lane closure on two-lane, two-way pavement.

**701.14 Signs.** When work operations exceed four days, signs shall be post mounted unless the signs are located on the pavement or define a moving or intermittent operation. When approved by the Engineer, temporary sign supports may be used where posts are impractical. When post mounting is not required, either temporary sign supports or sign trailers may be used.

Post mounted signs shall be a "breakaway" design as shown on the plans. The signs shall be within five degrees of vertical. Two posts shall be used for signs greater than 16 sq ft (1.5 sq m) in area or where the height between the sign and the ground exceeds 7 ft (2.1 m). Bracing no heavier than 2 x 4 in. (50 x 100 mm) wood may be used for added support and shall be placed parallel to the road sloping down toward approaching traffic.

Signs on temporary supports shall meet the requirements of NCHRP Report 350. The signs shall be supported within 20 degrees of vertical. Weights used to stabilize signs shall be attached to the sign support as per the manufacturer's specifications.

Sign trailers, when erected, shall have their tires resting on the ground or elevated a maximum of 6 in. (150 mm) above the ground. Weights used to stabilize the trailer shall be sandbags mounted a maximum of 12 in. (300 mm) above the ground. To prevent wind induced rolling of the trailer, the wheels shall be chocked with sandbags or the trailer tongue may be pinned. The pinning method shall be

designed to give way in the event of a vehicular impact and shall meet the approval of the Engineer.

The sign trailer shall only be attached to its tow vehicle when the sign is actually being moved. The tow vehicle, when not attached to the trailer, shall be parked according to Article 701.11.

Longitudinal dimensions shown on the plans for the placement of signs may be increased up to 100 ft (30 m) to avoid obstacles, hazards, or to improve sight distance, when approved by the Engineer.

- (a) "ROAD CONSTRUCTION AHEAD" Signs. "ROAD CONSTRUCTION AHEAD" signs shall be erected on all side roads located within the limits of the mainline "ROAD CONSTRUCTION AHEAD" signs.
- (b) Work Zone Speed Limit Signs. Work zone speed limit sign assemblies shall be provided and located as shown on the plans. Two additional assemblies shall be placed 500 ft (150 m) beyond the last entrance ramp for each interchange or sideroad.

All permanent "SPEED LIMIT" signs located within the work zone shall be removed or covered. This work shall be coordinated with the lane closure(s) by promptly establishing a reduced posted speed zone when the lane closure(s) are put into effect and promptly reinstating the posted speed zone when the lane closure(s) are removed.

The work zone speed limit signs and end work zone speed limit signs shown in advance of and at the end of the lane closure(s) shall be used for the entire duration of the closure(s).

The work zone speed limit signs shown within the lane closure(s) shall only be used when workers are present in the closed lane adjacent to traffic. The sign assemblies shown within the lane closure(s) will not be required when the worker(s) are located behind a concrete barrier wall.

**701.15 Traffic Control Devices.** The number, type, color, size, and placement of traffic control devices shall be according to the traffic control plan, the MUTCD, and the Department's "Quality Standard for Work Zone Traffic Control Devices". Work shall not begin until the Engineer has determined the devices meet the quality requirements.

For devices covered by NCHRP Report 350, the Contractor shall provide a manufacturer's self-certification letter for each Category 1 device and an FHWA acceptance letter for each Category 2 and Category 3 device used on the contract. The letters shall state the device meets NCHRP Report 350 requirements for its respective category and test level, and shall include a detailed drawing of the device. The set-up and use of certified/accepted devices shall be the same as that described in the letter.

All devices shall be kept clean. Any device which has become ineffective due to damage or defacement shall be replaced.

Devices having angled striping shall be oriented with the stripes sloping down toward the side on which traffic will pass. Lights on devices shall be mounted on the side of the device on which traffic shall pass and shall not obscure any reflectorized portion of the device.

Where more than one type of device is permissible, only one type of device shall be used within that individual run of devices or lane closure taper.

Additional requirements for the use of specific devices are as follows.

- (a) Cones. Cones are used to channelize traffic during daylight operations. Reflectorized cones are for nighttime operations, but shall only be used when specified in the plan or when approved by the Engineer.
- (b) Type I, II, and III Barricades. Type I and Type II barricades are used to channelize traffic; to delineate unattended obstacles, patches, excavations, drop-offs, and other hazards; and as check barricades.

Type I barricades are for use on roads with normal posted speeds of 40 mph or less. However, they may be used on higher speed roads provided the reflective area of the upper rail is at least 2 sq ft (0.18 sq m).

Type III barricades are used to close lanes and to close roads.

- (c) Vertical Barricades. Vertical barricades are used to channelize traffic, as well as to delineate unattended obstacles, patches, excavations, drop-offs, and other hazards. Vertical barricades shall not be used in lane closure tapers or as check barricades.
- (d) Vertical Panels. Vertical panels are used to channelize traffic and to delineate unattended excavations and drop-offs.
- (e) Direction Indicator Barricades. Direction indicator barricades are used in lane closure tapers.
- (f) Drums. Drums are used to channelize traffic and to delineate unattended obstacles, patches, excavations, drop-offs, and other hazards.
- (g) Flexible Delineators. Flexible delineators are used to channelize traffic. They shall only be used when specified.
- (h) Truck Mounted Attenuators. Trailing vehicles shall be between 200 and 500 ft (60 and 150 m) behind the vehicle ahead or the workers.
- (i) Arrow Boards. Arrow boards are used to warn motorists of an upcoming lane closure. Arrow boards shall not be used to direct passing moves into lanes used by opposing traffic or to shift traffic without having a lane change.

On roads with normal posted speeds of 45 mph and above, Type C units shall be used for all operations 24 hours or more in duration, and Type B units may be used for operations less than 24 hours in duration. On roads

with normal posted speeds less than 45 mph, Type A, B, or C units may be used for all operations.

- (j) Portable Changeable Message Signs. These signs shall be furnished, placed, and maintained according to the traffic control plan and as directed by the Engineer.

The Contractor shall supply the modem, the cellular phone, and the necessary software to run the sign from a remote computer at a location designated by the Engineer. The Contractor shall promptly program and/or reprogram the computer to provide the messages as directed by the Engineer.

The Contractor shall provide all preventive maintenance efforts deemed necessary to achieve uninterrupted service. If service is interrupted for any cause and not restored within 24 hours, the Engineer will cause such work to be performed as may be necessary to provide this service and the cost of such work will be deducted from compensation due or which may become due the Contractor under the contract.

- (k) Temporary Rumble Strips. Temporary rumble strips shall be placed snugly against one another and attached to the pavement with an adhesive meeting the recommendations of the rumble strip manufacturer.

**701.16 Lights.** Lights shall be used on devices as required in the traffic control plan and the following table.

Circumstance	Lights Required
Daylight operations	None
First two warning signs on each approach to the work involving a nighttime lane closure	Flashing mono-directional lights
Devices delineating isolated obstacles, excavations, or hazards at night. (Does not apply to patching)	Flashing bi-directional lights
Devices delineating obstacles, excavations, or hazards exceeding 100 ft (30 m) in length at night. (Does not apply to widening)	Steady burn bi-directional lights
Channelizing devices for nighttime lane closures on two-lane roads	Steady burn bi-directional lights.
Channelizing devices for nighttime lane closures on multi-lane roads	Steady burn mono-directional lights
Devices in nighttime lane closure tapers	Steady burn mono-directional lights
Devices delineating a widening trench	None
Devices delineating patches at night on roadways with an ADT less than 25,000	None
Devices delineating patches at night on roadways with an ADT of 25,000 or more	Steady burn mono-directional lights

Batteries for the lights shall be replaced on a group basis at such times as may be specified by the Engineer.

**701.17 Specific Construction Operations.** Additional requirements for specific construction operations shall be as follows.

- (a) Portland Cement Concrete Shoulders. Portland cement concrete shoulders shall be opened to traffic according to Article 701.17(c)(5).
- (b) Base Course.
  - (1) Aggregate Base Course. The road or any section 1 mile (1.6 km) or more in length shall be opened to local traffic immediately after it has been completed.
  - (2) Soil-Cement Base Course. The finished soil-cement base course may be opened immediately to local traffic and to the Contractor's construction equipment. The base may be opened to all traffic after the seven day protection period, provided the base course is not damaged, marred, or distorted by such traffic, and provided the protection and cover specified in Article 352.13 is not impaired.
- (c) Surface Courses and Pavement. Where construction operations on two-lane roads open to traffic result in the removal or covering of any pavement striping indicating passing restrictions, "NO PASSING ZONES NOT STRIPED NEXT \_ MILES" signs shall be used. The Contractor shall place the signs at the beginning of the unstriped area, just beyond each major intersection within the unstriped area, and at other locations as directed by the Engineer to ensure a minimum spacing of 5 miles (8 km). The signs shall be placed just prior to removal or covering of the striping and shall remain in place until full no passing zone striping has been restored.
  - (1) Prime Coat. "FRESH OIL" (W21-2) signs shall be erected when prime and fine aggregate are applied to pavement that is open to traffic. The signs shall remain until tracking of the prime ceases as directed by the Engineer. The signs shall be erected a minimum of 500 ft (150 m) preceding the start of the prime.
  - (2) Cold Milling. "ROUGH GROOVED SURFACE" (W8-I107) signs shall be erected when the road has been cold milled and opened to traffic. The signs shall be placed just prior to the cold milling operation and shall remain in place until the milled surface condition no longer exists. These signs shall be erected a minimum of 500 ft (150 m) preceding the start of the milled pavement, just before each major intersection within the milled area, and at other locations as directed by the Engineer. The signs shall have an amber flashing light attached.
  - (3) HMA Binder and Surface Course. The road shall be kept open to traffic on the existing pavement or on the new work. During the actual cleaning of the pavement and the placing of the mixture for cracks, joints and flangeways, prime coat, leveling binder, binder and surface

courses, one-way traffic will be permitted. At all other times, two-way traffic will be allowed to use the road.

- (4) Bituminous Surface Treatment. The surface may be opened to traffic as soon as it has cured sufficiently to prevent the material from being picked up by the wheels of vehicles passing over it.
- (5) Portland Cement Concrete Pavement. When the curing period for the pavement, according to Article 1020.13, has been completed and the joints have been sealed, as required in Article 420.12, and protective coat, when required, is applied, the Engineer will determine when the pavement shall be opened to traffic. The earliest the pavement will be opened to traffic will be when test specimens according to Article 1020.09 have attained a flexural strength of 650 psi (4,500 kPa) or a compressive strength of 3500 psi (24,000 kPa). If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete is placed or until 28 days when fly ash or ground granulated blast-furnace slag is used in the concrete mixture. Prior to opening to traffic, the pavement shall be cleaned. The Contractor may request additional test specimens be made and tested if the Contractor wishes to open the pavement to traffic earlier than the normal testing frequency. All traffic including construction traffic shall be limited to legal axle weights (legal loads).

(d) Structures.

- (1) Concrete Superstructures. Concrete superstructures shall be opened to traffic according to Article 503.20.
- (2) Box and Pipe Culvert Extensions. Box culvert and pipe culvert extensions shall be delineated with barricades until the backfill over the extensions is complete and no longer poses a hazard to traffic.
- (3) Storm Sewers Jacked in Place. The construction operations shall be carried on without encroachment upon the traveled way by either the excavation or by the storage of equipment or materials. When open cut excavation encroaches upon the shoulder, the excavation shall be delineated according to Article 701.11.
- (4) Bridge Washing. The entire bridge roadway and roadways below shall be kept open to traffic at all times, other than when actual work is being performed. While actual work is being performed, one-half the roadway may be closed to traffic at the option of the Contractor. One-way traffic shall be permitted over the other half of the roadway if the bridge roadway is less than 40 ft (12.2 m) in width. Two-way traffic shall be permitted over the other half of the roadway if the bridge roadway width is 40 ft (12.2 m) or more between curbs. Traffic control devices shall be as specified for each bridge.

## (e) Pavement Patching.

- (1) Keeping Road Open to Traffic. Traffic shall be permitted to use the road at all times and construction operations shall be arranged to facilitate the movement of traffic. On two-lane roadways, construction operations shall be confined to one traffic lane. On four-lane roadways, construction operations shall be confined to one traffic lane in each direction.

In addition to the traffic control and protection shown elsewhere in the contract for multi-lane pavement, two devices shall be placed immediately in front of each open patch, open hole, and broken pavement where temporary concrete barriers are not used to separate traffic from the work area. One device shall be placed at the edge of the open traffic lane and one device centered in the closed lane. A check barricade shall be placed in the middle of the closed lane and the adjacent shoulder at 1000 ft (300 m) centers.

When patching on ramps, a minimum of three standard 48 in. (1.2 m) signs ("RAMP CONSTRUCTION", "NARROW LANE", and "FLAGGER" or Flagger Symbol signs) and one flagger shall be required as directed by the Engineer. The work area shall be delineated by channelizing devices at 50 ft (15 m) spacings or closer if directed by the Engineer.

- (2) Broken Pavement and Open Holes.

- a. Multilane Roadways. Prior to weekend or holiday periods, pavement broken and holes opened for patching shall be completed and the road fully opened. For HMA patching or when Class PP-2, PP-3, or PP-4 concrete is specified, no broken pavement, open holes, or partially filled patches shall remain overnight and all devices shall be removed before dark.

The total area of pavement broken and not removed for concrete patching shall not exceed 1/2 of the total area of broken pavement which can be removed in an average day's work. The total area of holes left open overnight for concrete patching shall not exceed 1/2 of the pavement area which can be replaced in an average day's work. No materials removed from patches shall remain on the right-of-way overnight.

- b. Two Lane Roadways and Ramps. No broken pavement, open holes, or partially filled patches shall remain overnight and all devices shall be removed before dark.

If patches are not opened when required, additional traffic control shall be provided at no additional cost to the Department.

- (3) Opening Road to Traffic.

- a. Cleaning Up. Prior to opening the pavement to traffic, the entire right-of-way adjacent to the patching operations shall be cleared of

all materials caused by the Contractor's operations, and the backfill along the shoulder edge of the pavement shall be compacted.

- b. **Strength Tests.** For patches constructed with Class PP-1, PP-2, PP-3, or PP-4 concrete, the pavement may be opened to traffic when test specimens have obtained a minimum flexural strength of 600 psi (4,150 kPa) or a minimum compressive strength of 3200 psi (22,100 kPa) according to Article 1020.09.

For patches constructed with Class PP-2, PP-3, or PP-4 concrete which can obtain a minimum flexural strength of 600 psi (4150 kPa) or a minimum of compressive strength of 3200 psi (22,100 kPa) in 16 hours, the pavement may be opened to traffic when test specimens have obtained a minimum flexural strength of 300 psi (2050 kPa) or a minimum compressive strength of 1600 psi (11,000 kPa) according to Article 1020.09.

With the approval of the Engineer, concrete strength may be determined according to Illinois Modified AASHTO T 325.

- (f) **Guardrail.** Where guardrail is temporarily removed or where the guardrail installation is incomplete, devices shall be placed at 50 ft (15 m) centers.

On staged construction bridge projects, the parapets shall have the guardrail installed and attached prior to switching traffic.

Guardrail removal and/or installation shall be scheduled so no installations are left unfinished when the work is suspended for the winter or other extended periods of time.

**701.18 Highway Standards Application.** Standards for work zone traffic control shall be applied according to the traffic control plan. Additional requirements for specific Standards shall be as follows.

- (a) Standard 701006, 701011, and 701101. When the work operation requires four or more work vehicles enter through traffic lanes in a one hour period, a flagger shall be provided and a "FLAGGER" sign shall be substituted for the "WORKER" sign.
- (b) Standard 701316 and 701321. The exact location of the signals, detector loops, stop bars, and signs shall be as directed by the Engineer. The locations shall also be adjusted as required for staged construction.

The Engineer shall be notified at least 72 hours in advance of placing the signals in operation and at least one week prior to a traffic lane width reduction.

Any damage to the temporary traffic signals from any cause shall be repaired at no additional cost to the Department. If at any time the Contractor fails to perform any work deemed necessary by the Engineer to keep the temporary traffic signals in proper operating condition, the Department reserves the right to have other electrical Contractors perform

the needed work, and the cost will be deducted from compensation due or which may become due the Contractor under the contract.

- (1) Standard 701316. During daytime operations when workers are present, the Engineer may allow Type I or Type II barricades to be placed parallel to the centerline. Cones may be substituted for barricades at half the barricade spacing during the daytime operations.
- (2) Lane Closure on Two-Way, Two-Lane Rural Road. The Contractor shall furnish, install, maintain, and remove temporary traffic signals including a traffic actuated controller, a cabinet, detector amplifiers, and other associated equipment as listed below and on Standards 701316 and 701321 for each location specified. The Contractor shall have available one spare controller and cabinet. The Contractor shall retain ownership of all traffic control equipment, miscellaneous accessories, and the installation methods shall be according to the following.
  - a. Traffic Signal Heads. Two signal heads shall be provided for each mainline approach and for each sideroad within the designated work area. All signal faces shall have new lamps when installed. When the signals are not operating, the signal head shall be hooded according to Article 880.03 and the "SIGNAL AHEAD" sign covered or removed. The left signal head shall be mounted at a height of 10 ft (3.1 m) above the road surface measured to the bottom of the signal head. The right signal head shall be mounted at a height of 14 ft (4.3 m) above the road surface. Back plates will be required on all signals.

The right signal head shall be aimed so the centers of the light beams of the indications are directed toward a point in the center of the approach lane 500 ft (150 m) in advance of the signal. The left indication shall be aimed at a point in the center of the approach lane 100 ft (30 m) in advance of the stop line.
  - b. Lenses. All lenses shall be 12 in. (300 mm) nominal diameter.
  - c. Wire and Cable. The Contractor shall supply all overhead and underground wiring for both signal circuits and loop detector lead-ins. The electric cable shall be aerially suspended, at a minimum height of 8 ft (2.5 m) and as close to the right-of-way line as possible. When the electric cable crosses a roadway or entrance, it shall be aerially suspended, at a minimum height of 18 ft (5.5 m), according to the local utility requirements, or placed in a trench with a minimum of 2 in. (50 mm) of cover, or protected in a manner approved by the Engineer.
  - d. Mounting. The controller shall be mounted on a post, pole, or temporary concrete foundation. The signal heads shall be mounted on 25 ft (7.5 m) standard tubular steel posts or on a minimum Class 4 wood pole, when overhead wiring is used between signals. Alternative methods of mounting the cabinet or signal heads shall

be approved by the Engineer. The supports shall be kept in a vertical position for the duration of the project.

- e. Service Installation. The Contractor shall be responsible for the installation and cost of 110 V electrical service. When the service cable from the controller to the power source is suspended overhead, the line height shall not be less than 8 ft (2.5 m) above the ground and located as close to the right-of-way lines as practicable. When the cable crosses a roadway or entrance, the cable shall be raised to a minimum height of 18 ft (5.5 m) or pass under the pavement through a culvert opening. Portable power generating equipment may be used for a short period of time until local power is available, provided at least one person is present at all times at the site to ensure proper operation.

- f. Traffic Signal Controller.

1. The controller shall be a standard eight phase NEMA controller housed in a weather proof cabinet. The traffic signals shall dwell in All-Red. The long All-Red intervals shall be adjustable up to 99 seconds in one second increments. Long All-Red intervals shall be obtained by using a trail green feature or an equivalent, or by using dummy phases. The long All-Red interval shall be pre-empted if the previous movement is detected before the conflicting movement is detected and shall cause the previous movement to return to the green display with a minimum four second delay. When a conflict or failure is detected, the signal shall display a flashing All-Red. When an additional phase is used for a side road movement, only one long red interval shall be used between active phases on each side of the work area.

All devices used, in lieu of controller software to produce this sequence, shall be mounted within the cabinet but not within the controller. The Contractor shall provide an operational demonstration of the controller assembly for the Engineer subsequent to installation and prior to being placed into operation. The Contractor shall program the controller, trouble shoot, and correct any problems that arise, and verify the equipment is functioning according to the contract. If any controller malfunction occurs during the time of operation or in the event of a power failure, the Contractor shall, without delay, provide flaggers for traffic control and immediately install a replacement controller to operate the signals.

2. When specified, the Department will furnish the traffic actuated controller. The controller, complete with loop detector-amplifiers and pole mount cabinet, shall be picked up and returned upon completion of the project to the location designated on the plans. The Contractor shall provide notice to the Department at least two weeks in advance of requiring the traffic actuated controller. The Contractor shall be

responsible for maintenance of the controller and all related equipment within the controller cabinet. The controller shall be inspected by the Contractor and Engineer subsequent to installation and prior to being placed into operation. Any malfunction of the Department owned equipment revealed during the inspection by the Contractor shall be repaired and will be paid for according to Article 109.04. The Contractor shall be responsible for any damage to the Department-owned equipment as a result of negligence or poor workmanship during installation at his/her expense. The Contractor shall provide all maintenance required, at his/her expense, to keep the Department-owned equipment functioning properly after being placed in operation.

- g. Detector Loops. Three detector loops shall be installed on each approach as shown on the plans. The near detector loops shall be placed 12 in. (300 mm) from the centerline and the far loop shall be placed 12 in. (300 mm) from the edge line. Each loop shall be connected to a separate detector amplifier channel. Call delay feature shall be used for the loops nearest the stop lines and defeated during the green of that phase. An alternate method of detection may be used if it has been demonstrated and approved by the Department.

The loop detector lead-in cable shall be protected from construction and maintenance activities. In the event of detector loop failure, the Contractor shall have 48 hours to repair or replace the loops. Upon completion of the project, the detector loop shall be terminated in such a manner as to provide for future use.

- (c) Standard 701326. No paving or excavating operations shall be performed at night unless authorized by the Engineer.
- (d) Standard 701336. Two flaggers shall be required for each separate construction operation. The flagger shall be a minimum of 200 ft (60 m) and a maximum distance of 1/2 day's operation beyond the flagger sign and a minimum of 100 ft (30 m) in advance of the work party.

Under restricted sight distance conditions, additional devices may also be required for distances less than 2000 ft (600 m) at the discretion of the Engineer.

| During periods when workers are present all work areas shall be delineated by cones or barricades along the centerline.

- (e) Standards 701400, 701401, 701406, 701421, 701422, and 701446.
  - (1) General. When Standards 701401 and 701422 are specified for overnight operations, cones may be substituted for barricades or drums at half the spacing during day operations.

- (2) Multilane Pavement Resurfacing. For the construction of binder course, surface course and shoulder resurfacing on multilane pavements, Standards 701401, 701406, 701421, 701422, or 701446 shall be used from the beginning of business on Monday to 4:30 p.m. on Friday. Only Standards 701406 and 701421 shall be used from 4:30 p.m. Friday to start of business on Monday.
- (3) Shoulder Upgrading and Replacement. The following shall apply to shoulder pipe underdrain installation and/or shoulder reconstruction on existing multilane divided highways.

The Contractor shall close the adjacent lane of pavement according to the Standards within the limits of the construction zone a) when required by the Contractor's operations and b) when no workers are present and the difference in elevation between the pavement and the shoulder and/or widening is greater than 12 in. (300 mm).

During shoulder work on ramps, a minimum of two standard advance signs, a 48 in. (1.2 m) "RAMP CONSTRUCTION AHEAD", and a 48 in. (1.2 m) "FLAGGER AHEAD" or Flagger Symbol sign, and one flagger shall be used as directed by the Engineer. The work area shall be delineated by devices at 50 ft (15 m) spacings. Shoulder drop-offs greater than 1 1/2 in. (40 mm) caused by the Contractor's operations will be allowed only on one side of the ramp at a time.

Standards 701401 and 701422 will only be measured for payment where the average depth of shoulder reconstruction required by the plans, exclusive of any trench for pipe underdrain installation, is in excess of 3 in. (75 mm). Where such shoulder reconstruction is 3 in. (75 mm) or less, no open trench greater than 3 in. (75 mm) deep will be permitted overnight. If, because of unforeseen circumstances, an open trench greater than 3 in. (75 mm) deep should occur overnight, the Contractor shall, at no additional cost to the Department, close the adjacent traffic lane according to Standards 701400 and 701401 or according to Standard 701422.

Excavations greater than 3 in. (75 mm) in depth between the pavement and shoulder, including any trenches within the shoulder area, shall be restricted to one shoulder in each direction of travel. In addition, shoulder drop-offs greater than 1 1/2 in. (40 mm) caused by the Contractor's operations will not be permitted over the winter shutdown.

The Contractor shall schedule the work so the lane closure at any one work area does not exceed five working days. The closure time may be exceeded for conditions beyond the Contractor's control, except if continual and persistent closures in excess of the five working days are made, the Engineer will initiate measures to delay or limit the daily production of the Contractor's operations.

All debris shall be removed from the shoulder and right-of-way prior to the removal of barricades, drums, or vertical panels.

- (f) Standard 701416. Reflective solid edge lines and double yellow centerline shall be used when the closure time exceeds four days or when the normal posted speed outside the area of operations exceeds 50 mph. Reflectorized pavement marking tape shall be used for marking the edge lines and centerline on existing pavement. Either tape or reflectorized pavement marking paint may be used for markings on the paved crossovers. Raised reflective pavement markers at 25 ft (8 m) centers shall also be installed under good weather conditions for additional delineation.

Vertical panels may be attached to concrete barriers where available space prohibits the use of drums.

- (g) Standard 701431. Reflective solid edge lines and a double yellow centerline shall be used when the closure time exceeds four days or when the normal posted speed outside the area of operations exceeds 50 mph. Reflectorized pavement marking tape shall be used for marking the centerline and edge lines on the existing pavement. Raised reflective pavement markers at 25 ft (8 m) centers shall be installed under good weather conditions to supplement the pavement marking tape. All existing pavement markings which conflict with the revised traffic pattern shall be removed.

Devices no greater than 24 in. (600 mm) wide, may be used in place of flexible delineators when the two-way operation is to be in place four days or less.

- (h) Standard 701426. Truck mounted attenuators will not be required for any vehicle traveling entirely on a completed shoulder.
- (i) Standard 701411. This Standard shall supplement mainline traffic controls for lane closures.

The channelizing devices shall clearly define a path for motorists entering or exiting the highway.

Reflectorized temporary pavement marking tape shall be placed throughout the barricaded area of each ramp where the closure time exceeds 14 days. Raised reflectorized pavement markers at 25 ft (8 m) centers may be used in lieu of tape where the pavement marking is to be placed adjacent to the barricades or drums.

- (j) Urban Traffic Control, Standards 701501, 701502, 701601, 701602, 701606, 701701, and 701801.

- (1) General. "NO PARKING" signs shall be installed throughout the work area.

When the work area is in the parking lane and parking exists during work hours, "ROAD CONSTRUCTION AHEAD" or "ROAD WORK AHEAD" signs shall be installed 200 ft (60 m) in advance of the work area and the area shall be delineated with cones or barricades.

Reflectorized temporary pavement marking tape shall be placed throughout the taper and along side the adjacent work area where the closure time exceeds 14 days. The edge line shall be yellow for left lane closures.

- (2) Standard 701501. When Standard 701501 is specified on two-lane/two-way roadways, construction operations shall be confined to one traffic lane leaving the opposite lane open to traffic.
- (3) Standard 701606. When Standard 701606 is specified reflective pavement markings shall be used when the closure time exceeds four days. The double yellow centerline shall be used in the two-way traffic area in addition to the barricades or drums. Single yellow left edge line shall be used to outline the barricade island. White right edge line shall be used along the barricades delineating the work area.
- (4) Standard 701801. On Standard 701801, where a temporary walkway encroaches on an existing parking lane, the lane shall be closed with cones, barricades, or drums.

Where a temporary walkway encroaches on a traveled lane, the lane shall be closed according to Standards 701501, 701606, or 701601.

All walkways shall be clearly identified, protected from motor vehicle traffic and free of any obstructions and hazards, such as holes, debris, construction equipment, and stored materials.

All hazards near or adjacent to walkways shall be clearly delineated.

When barricades are impractical to use or do not provide enough protection, orange safety fence shall be used to close off an area, with the approval of the Engineer.

**701.19 Method of Measurement.** This work will be measured for payment as follows.

- (a) Not Measured. Traffic control and protection required under Standards 701001, 701006, 701011, 701101, 701106, 701301, 701311, and 701426 will not be measured for payment.
- (b) Standards 701401, 701422, and 701446 will be measured for payment on an each basis only when the traffic control and protection applies to isolated stationary work areas and does not involve or is not a part of other protected areas.

Where the contract work to be performed requires longitudinal movement of the work area, each subsequent installation of a Standard in a new location will be paid for according to Article 109.04. A contiguous lateral movement of the work area causing a change in the location of traffic control devices, but not a longitudinal relocation of the work area, will not be considered a new location or installation.

- (c) Measured As Lump Sum. Traffic control and protection required under Standards 701201, 701206, 701306, 701326, 701336, 701400, 701406, 701421, 701501, 701502, 701601, 701602, 701606, 701701 and 701801 will be measured for payment on a lump sum basis. Traffic control and protection required under Standards 701401, 701422, and 701446 will be measured for payment on a lump sum basis, except as specified under Article 701.19(b). Where the Contractor's operations result in daily changing, or two or more work areas each of which requires traffic control according to one of the above Standards, each work area installation will not be paid for separately, but shall be included in the lump sum price for the type of protection furnished.
- (d) Traffic Control Surveillance will be measured on a calendar day basis.
- (e) Temporary rumble strips will be measured as each, where each is defined as a 25 ft (8 m) length installation.

**701.20 Basis of Payment.** This work will be paid for as follows.

- (a) Traffic control and protection will be paid for at the contract unit price per each for TRAFFIC CONTROL AND PROTECTION STANDARD 701316, TRAFFIC CONTROL AND PROTECTION STANDARD 701321, TRAFFIC CONTROL AND PROTECTION STANDARD 701331, TRAFFIC CONTROL AND PROTECTION STANDARD 701401, TRAFFIC CONTROL AND PROTECTION STANDARD 701402, TRAFFIC CONTROL AND PROTECTION STANDARD 701411, TRAFFIC CONTROL AND PROTECTION STANDARD 701416, TRAFFIC CONTROL AND PROTECTION STANDARD 701422, TRAFFIC CONTROL AND PROTECTION STANDARD 701423, TRAFFIC CONTROL AND PROTECTION STANDARD 701431, or TRAFFIC CONTROL AND PROTECTION STANDARD 701446, at the location specified.

The replacement of any temporary pavement marking which has been in place for seven days or more will be paid for according to Article 109.04.

In the event the total value of the work items for which a traffic control Standard is required is increased or decreased by more than ten percent, the unit price bid for that Standard will be adjusted as follows.

$$\text{Adjusted unit price} = 0.25P + 0.75P (1 \pm (X - 0.1))$$

Where: P is the bid unit price for the Standard

$$\text{Where: } X = \left| \frac{\text{Difference between original and final value of work}}{\text{Original value of work requiring the use of the Standard}} \right|$$

And where: ( X - 0.1) = 0 if X is less than 0.1

The value of the work items used in calculating the increase or decrease will include only items which have been added to or deducted from the contract under Article 104.02 and only items which require use of the Standard.

When the plans require multiple locations for the Standard and the Method of Measurement is on an each basis, the adjustment shall only be applied to the location(s) where added work is required.

- (b) Traffic control and protection indicated in Article 701.19(c) will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION
- |          |         |         |         |         |            |            |
|----------|---------|---------|---------|---------|------------|------------|
| STANDARD | 701201; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701206; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701306; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701326; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701336; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701400; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701401; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701406; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701421; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701422; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701446; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701501; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701502; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701601; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701602; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701606; | TRAFFIC | CONTROL | AND     | PROTECTION |            |
| STANDARD | 701701; | or      | TRAFFIC | CONTROL | AND        | PROTECTION |
| STANDARD | 701801. |         |         |         |            |            |

Any alterations (additional or replacement of temporary pavement markings, or increases or decreases in work items by more than ten percent for which a traffic control standard is required) will be paid for according to Article 701.20(a).

- (c) Temporary signals required for Standards 701316 and 701321 will be paid for separately at the contract unit price per each for TEMPORARY BRIDGE TRAFFIC SIGNALS.

When the Department furnishes the controller for Standards 701316 or 701321 the temporary bridge traffic signals will be paid for at the contract unit price per each for TEMPORARY BRIDGE TRAFFIC SIGNALS (STATE FURNISHED CONTROLLER).

- (d) Temporary concrete barrier will be measured and paid for according to Section 704.
- (e) Temporary impact attenuators and temporary bridge rail will be paid for separately.
- (f) Temporary rumble strips will be paid for at the contract unit price per each for TEMPORARY RUMBLE STRIPS.
- (g) Traffic Control Surveillance will be paid for at the contract unit price per calendar day or fraction thereof for TRAFFIC CONTROL SURVEILLANCE.

- (h) When portable changeable message signs are shown on the Standard, this work will not be paid for separately but shall be considered as included in the cost of the Standard.

For all other portable changeable message signs, this work will be paid for at the contract unit price per calendar month for each sign as CHANGEABLE MESSAGE SIGN.

- (i) Should the Engineer require additional signs, flaggers, barricades, or other traffic control devices over and above those specified, they will be paid for according to Article 109.04.

When the Contractor requests a change in the traffic control, any additional flaggers required will be at no additional cost to the Department.

**SECTION 702. RESERVED**

**SECTION 703. WORK ZONE PAVEMENT MARKING**

**703.01 Description.** This work shall consist of furnishing, installing, maintaining, and removing short term and temporary pavement markings.

**703.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Pavement Marking Tape .....	1095.06
(b) Paint Pavement Markings .....	1095.02

**CONSTRUCTION REQUIREMENTS**

**703.03 General.** Short term pavement markings shall consist of abbreviated patterns for edge, lane, and centerline markings. Within a specified time limit, short term pavement markings shall either be resurfaced or replaced with the full pavement marking patterns indicated on the plans with either a temporary material paid for as temporary pavement marking or with permanent material. Within the conditions as specified, the Contractor may be required to place all or a part of the quantities shown on the plans for short term pavement markings and temporary pavement markings.

The surface to which the pavement marking is to be applied shall be clean and dry. Pavement marking tape shall be applied to the prepared surface according to the manufacturer's recommendations or by a method approved by the Engineer. Painted lines shall be installed according to Section 780, except hand-operated strippers may be used for all applications of short term and temporary pavement marking.

**703.04 Short Term Pavement Markings.** Before the lane is opened to traffic, appropriate short term pavement markings shall be installed between all lanes open to traffic. Centerline or lane line markings shall consist of an abbreviated pattern of single stripes 4 ft (1.2 m) in length and a minimum of 4 in. (100 mm) wide at a

maximum spacing of 40 ft (12 m) between stripes. Centerlines on two-lane highways shall be yellow and lane lines separating two or more lanes of traffic moving in the same direction shall be white. Edge line markings shall consist of 4 ft (1.2 m) stripes on 100 ft (30 m) centers installed at approximately a 45 degree diagonal pointing in the direction of traffic. Edge line markings will only be required on multilane divided highways and other highways with a paved shoulder greater than 4 ft (1.2 m) wide. Markings on the final wearing surface shall be transversely offset from the permanent pavement marking location as directed by the Engineer. Markings shall be removed within five days after the permanent pavement markings are installed.

The short term pavement markings shall be replaced with the required full standard pavement markings consisting of either temporary or permanent pavement marking as soon as possible. Except as indicated below, temporary pavement marking or the permanent pavement markings shall be installed for no passing zones within three calendar days and for all other markings within 14 calendar days, respectively, after the completion of any intermediate or final surface treatment. This time restriction shall begin at the completion of each intermediate or final lift on resurfacing projects.

If the existing markings are obliterated by milling or any other surface treatment, the time restriction shall begin when the entire surface has been treated. These restrictions may be delayed by the Engineer whenever the Contractor cannot apply pavement markings due to unanticipated inclement weather (other than winter shutdown on the project), strike activities, or other circumstances beyond the Contractor's control as determined by the Engineer. In these cases, the required full standard temporary or permanent markings shall be installed as soon as construction activities are resumed. Prior to winter shutdown, standard edge lines, lane lines, centerlines, no passing zones, and any other necessary markings as determined by the Engineer shall be installed on any intermediate or final surface remaining open to traffic during the winter shutdown period.

**703.05 Temporary Pavement Marking.** When any intermediate course cannot be overlaid or if the final surface cannot be permanently marked within the time restrictions listed above, the full standard markings shall be installed with temporary pavement marking. The temporary markings shall be of the same color and dimensions as shown on the plans for the permanent markings, or as directed by the Engineer.

Type I or Type II marking tape or paint shall be used at the option of the Contractor, except paint shall not be applied to the final wearing surface unless authorized by the Engineer for late season applications where tape adhesion would be a problem. Type III marking tape shall be used on the final wearing surface when the temporary pavement marking will conflict with the permanent pavement marking such as on tapers, crossovers and lane shifts.

Except during winter shutdown periods, temporary pavement marking showing deterioration for any reason within seven days after placement, shall be replaced by the Contractor. Temporary pavement markings which are in conflict with subsequently established pavement markings, or which interfere with the permanent pavement markings, shall be removed. Marking tape or paint placed on the final wearing course shall be transversely offset from the permanent pavement marking planned location as directed by the Engineer. All remaining temporary pavement

marking tape or paint shall be removed within five working days after placement of the permanent pavement marking. When edge lines or channelizing lines are required, they shall be continuous. When continuous sections of tape are used, they shall be cut completely through at intervals of approximately 25 ft (8 m).

Instead of pavement markings, no passing zones on two-lane and three-lane roads may be identified by either the pennant "NO PASSING ZONE" warning sign or both the "DO NOT PASS" and "PASS WITH CARE" regulatory signs in conjunction with short term markings for periods of time up to three calendar days after an intermediate or final lift is completed on resurfacing projects.

These signs may also be used in lieu of pavement markings on low volume roads until it is practical and possible to install the permanent pavement markings.

If, in the traffic control plan, the road is specified as low volume, it is exempt from the requirements regarding no passing zone pavement markings.

**703.06 Method of Measurement.** Short term pavement markings and temporary pavement markings of the various line widths will be measured for payment in feet (meters) in place and accepted. Double yellow lines will be measured as two separate lines.

The replacement of temporary pavement markings of the various line widths during winter shutdown periods will be measured for payment in feet (meters) as specified above, except only those pavement markings directed by the Engineer to be replaced will be measured for payment.

Letters and symbols used in conjunction with temporary pavement marking conforming to the sizes and dimensions specified will be measured for payment in square feet (square meters) according to the areas listed in Table 1, Section 780.

Short term and temporary pavement marking removal will be measured for payment in square feet (square meters).

**703.07 Basis of Payment.** This work will be paid for at the contract unit price per foot (meter) for SHORT TERM PAVEMENT MARKING or for TEMPORARY PAVEMENT MARKING of the line width specified, and at the contract unit price per square foot (square meter) for TEMPORARY PAVEMENT MARKING LETTERS AND SYMBOLS. Removal will be paid for at the contract unit price per square foot (square meter) for WORK ZONE PAVEMENT MARKING REMOVAL.

When temporary pavement marking is shown on the Standard, the cost of the temporary pavement marking will be included in the cost of the Standard.

When Pavement Marking Tape, Type III is specified in the contract other than on a Standard, the work will be paid for at the contract unit price per foot (meter) for PAVEMENT MARKING TAPE, TYPE III of the line width specified and at the contract unit price per square feet (square meter) for PAVEMENT MARKING TAPE, TYPE III - LETTERS AND SYMBOLS.

**SECTION 704. TEMPORARY CONCRETE BARRIER**

**704.01 Description.** This work shall consist of furnishing, placing, maintaining, relocating, and removing precast concrete barrier at temporary locations.

**704.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Precast Temporary Concrete Barrier .....	1042
(b) Reinforcement Bars (Note 1) .....	1006.10(a)
(c) Connecting Pins and Anchoring Pins .....	1006.09
(d) Connecting Loop Bars (Note 2)	
(e) Packaged Rapid Hardening Mortar or Concrete .....	1018

Note 1. Reinforcement bars shall be Grade 60 (Grade 400).

Note 2. Connecting loop bars shall be smooth bars according to the requirements of ASTM A 36.

**CONSTRUCTION REQUIREMENTS**

**704.03 General.** Precast concrete barrier shall be the F shape as detailed on the plans.

**704.04 Installation.** The barriers shall be seated on bare, clean pavement or paved shoulder and pinned together in a smooth, continuous line at the exact locations provided by the Engineer. The barrier unit at each end of the installation shall be secured to the pavement or paved shoulder using six anchoring pins and protected with an impact attenuator as shown on the plans.

Barriers or attachments damaged during transportation or handling, or by traffic during the life of the installation, shall be repaired or replaced. The Engineer will be the sole judge in determining which units or attachments require repair or replacement.

The barriers shall be removed when no longer required by the contract. After removal, all anchoring holes in the pavement or paved shoulder shall be filled with a rapid hardening mortar or concrete. Only enough water to permit placement and consolidation by rodding shall be used and the material shall be struck-off flush.

**704.05 Method of Measurement.** This work will be measured for payment in feet (meters) in place along the centerline of the barrier. When the barrier is relocated within the limits of the jobsite, the relocated barrier will be measured for payment in feet (meters) in place along the centerline of the barrier.

**704.06 Basis of Payment.** When the Contractor furnishes the barrier, this work will be paid for at the contract unit price per foot (meter) for TEMPORARY CONCRETE BARRIER or RELOCATE TEMPORARY CONCRETE BARRIER.

When the Department furnishes the barrier, this work will be paid for at the contract unit price per foot (meter) for TEMPORARY CONCRETE BARRIER, STATE OWNED; or RELOCATE TEMPORARY CONCRETE BARRIER, STATE OWNED.

Impact attenuators will be paid for separately.

**SECTION 705. TEMPORARY STEEL PLATE BEAM GUARDRAIL**

**705.01 Description.** This work shall consist of furnishing, erecting, maintaining, and removing steel plate beam guardrail, including posts and traffic barrier terminals.

**705.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Steel Plate Beam Guardrail .....	1006.25
(b) Wood Posts and Wood Blockouts .....	1007.01, 1007.02, 1007.06
(c) Steel Posts, Blockouts, Restraints, and Wire Rope for Guardrail .....	1006.23
(d) Preservative Treatment .....	1007.12
(e) Hollow Structural Tubing .....	1006.27(b)

**CONSTRUCTION REQUIREMENTS**

**705.03 General.** Construction of the temporary steel plate beam guardrail and temporary traffic barrier terminals shall be according to the applicable requirements of Sections 630 and 631, respectively.

The guardrail shall be removed after use and shall become the property of the Contractor.

**705.04 Method of Measurement.** Temporary steel plate beam guardrail will be measured for payment in feet (meters). The length measured will be the overall length of rail erected, measured along the top edge of the rail elements to the limits shown on the plans.

The various types of temporary traffic barrier terminals will be measured for payment complete in place in units of each. The pay limit between the terminal and the adjacent guardrail shall be as shown on the plans.

**705.05 Basis of Payment.** This work will be paid for at the contract unit price per foot (meter) for TEMPORARY STEEL PLATE BEAM GUARDRAIL of the type specified and at the contract unit price per each for TEMPORARY TRAFFIC BARRIER TERMINAL, of the type specified.

**SIGNING**

**SECTION 720. SIGN PANELS AND APPURTENANCES**

**720.01 Description.** This work shall consist of furnishing, fabricating, and/or installing sign panels, complete with sign faces, legend, and supplemental panels.

**720.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Sign Base .....	1090
(b) Sign Face .....	1091
(c) Sign Legend and Supplemental Panels .....	1092

The sign mounting support channel shall be manufactured from steel or aluminum.

Steel support channels shall be according to ASTM A 525 (mild strip) and Standard 720001 and shall be galvanized. Galvanizing shall be according to ASTM A 525, Coating Designation 90 when galvanized before forming and AASHTO M 232, Class B 2 when galvanized after forming.

Aluminum support channels shall be according to ASTM B 308M, Alloy 6061-T6 or ASTM B 221M, Alloy 6063-T6.

The stainless steel banding for mounting signs or sign support channels to light or signal standards shall be according to ASTM A 167 Type 302B, Grade 18-8 stainless steel.

**720.03 General.** The three types of individual panels are defined by surface area according to the following descriptions:

Type 1 – 9 sq ft (0.84 sq m) or less

Type 2 – Over 9 sq ft (0.84 sq m) and less than 24 sq ft (2.2 sq m)

Type 3 – 24 sq ft (2.2 sq m) or more

The surface area is determined by calculating the area of the smallest rectangle, measured from edge-to-edge (horizontally and vertically), that will circumscribe an individual sign, except in the case of a triangular sign. The area of a triangular sign shall be the net triangular area.

A sign panel assembly is composed of one or more sign panels mounted individually or as a group. The two types of sign panel assemblies are defined by the total surface area of the individual sign panels according to the following descriptions:

Type A assemblies are composed of Type 1 sign panels with a total sign panel area of 9 sq ft (0.84 sq m) or less.

Type B assemblies are composed of Type 1 or Type 2 sign panels with a total sign panel area over 9 sq ft (0.84 sq m).

Where any sign legend dimensions shown in the plans conflict with the sign legend manufacturer's recommendations, the dimensions shown in the plans or as determined by the Engineer shall govern.

The backs of all sign panels shall be metal stamped, engraved, etched, decal, or otherwise marked in a manner designed to last as long as the sign face material, in letters and numerals at least 3/8 in. (9.5 mm) but no more than 3/4 in. (19 mm) in height with the month and year of manufacture, the name of the sign manufacturer, and the initials IDOT.

When standard signs designated by letters and numbers are to be furnished, they shall be according to the MUTCD. Detailed drawings of signs with an "I" preceding the sign designation code are available from the Engineer of Operations. Detailed drawings of all other standard signs are available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

## CONSTRUCTION REQUIREMENTS

**720.04 Installation.** Sign panels shall be installed using all required supporting channels and mounting hardware specified.

All sheet aluminum sign panels and supporting panels shall be mounted to the sign posts or supporting channels with 5/16 in. (M8) stainless steel, zinc, or cadmium plated steel hex head bolts with lock nuts. For design panels 9 sq ft (0.84 sq m) or greater in area, flat steel fender washers shall be placed next to the bolt head and the nut. A 1/8 in. (3 mm) thick nylon washer shall be placed between the metal washer and the sign face. For sign panels less than 9 sq ft (0.84 sq m) in area, standard steel flat washer shall be placed next to the bolt head and nut. A nylon washer shall be placed between the metal washer and the sign face.

Supporting channels shall be used to brace sign panels mounted permanently on:

- (a) Single posts when the sign width is greater than 36 in. (900 mm).
- (b) More than one post when the distance between the posts is greater than 4 ft (1.2 m).

Horizontal supporting channels used to brace individual signs shall be located using the mounting holes prepunched in the sign blank.

All bolts and nuts shall have National Coarse Thread (UNC).

When a Type 2 panel is to be installed above or below a Type 3 panel, all materials shall be the same as those used for the Type 3 panel. The Contractor shall use the same type of sign base material and sign legend throughout this work.

When the plans require auxiliary sign panels or route shields to be installed on a Type 3 sign panel, they shall be fabricated using a sign base according to Article 1090.01 and a sign face according to Article 1091.01.

**720.05 Method of Measurement.** Sign panels will be measured for payment in square feet (square meters) according to Article 720.03.

**720.06 Basis of Payment.** This work will be paid for at the contract unit price per square foot (square meter) for SIGN PANEL, of the type specified.

**SECTION 721. SIGN PANEL OVERLAY**

**721.01 Description.** This work shall consist of furnishing, and installing sign panel overlays, complete with reflectorized or nonreflectorized sign face and legend, on existing sign panels.

**721.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Sign Base .....	1090
(b) Sign Face (Note 1) .....	1091
(c) Sign Legends (Note 2) .....	1092
(d) Overlay Panels (Note 3) .....	1090.02

Note 1. The sign face shall be Type A.

Note 2. The legend shall be Type A, except when black in color.

Note 3. The overlay panels shall be 0.08 in. (2 mm) thick.

**CONSTRUCTION REQUIREMENTS**

**721.03 General.** The existing sign shall be stripped of the sign legend, and the sign panel overlay and new legend shall be installed on the existing sign base. Ground-mounted sign panels may be taken down or the required work may be done in place. Any sign panel which is removed for overlaying shall be rigidly braced on the backside so the panel shall not flex and damage the overlay while being reinstalled. Sign panel hardware broken during removal of a sign panel shall be replaced.

The existing legend shall be completely removed, leaving no rivets protruding from the surface of the panel. The overlay shall be applied in vertical panels not more than 48 in. (1200 mm) nor less than 24 in. (600 mm) in width.

Adjacent panels shall be butt-joined with the spaces between joints 0.10 in. (2.5 mm) or less in width. No horizontal joints shall be used, except on sign panels over 12 ft (3.6 m) in height.

The panels shall be securely fastened to the sign with 3/16 in. (4.75 mm) aluminum dome head rivets with aluminum mandrels. All rivets shall be matched to

the color of the overlay panel being installed. The rivets shall be placed at 12 in. (300 mm) centers or less along all four edges and in a vertical row down the center of the panel at 24 in. (600 mm) centers or less. The rivets shall be approximately 1/4 in. (6 mm) in from open edges. All rivets shall be placed in the area of the aluminum extrusion panel ridge to prevent dimples in the sign panel overlay.

The sign sizes and legend sizes shown in the plans shall be verified in the field by the Contractor. The replacement legend shall be the same size and shall be spaced the same as the existing sign. The Contractor shall be responsible for the correct spacing of any revised legend according to the general freeway signing practices.

Individual signs shall not be out of service for longer than 24 consecutive hours, subject to the following conditions and exceptions.

- (a) No more than one advance guide sign of the sequence of signs on an approach to an interchange shall be out of service at any given time. (These signs are labeled "A" in the plans.)
- (b) Signs labeled "B" may be out of service at the same time as any other signs.
- (c) Signs labeled "C" are considered critical and shall be out of service no more than six consecutive hours and shall not be out of service when any "A" sign for the approach is also out of service.

**721.04 Method of Measurement.** The sign panel overlay will be measured for payment in square feet (square meters). The area used for measurement shall be the actual area of the sign panel overlay.

**721.05 Basis of Payment.** This work will be paid for at the contract unit price per square feet (square meters) for SIGN PANEL OVERLAY.

## **SECTION 722. DEMOUNTABLE SIGN LEGEND CHARACTERS AND ARROWS**

**722.01 Description.** This work shall consist of furnishing demountable legend characters, arrows, symbols, and route shields and installing them on existing sign panels.

**722.02 Materials.** Materials shall be according to the requirements for sign legend specified for Type 3 sign panels, in Table 1 of Section 1092.

### **CONSTRUCTION REQUIREMENTS**

**722.03 General.** Each demountable legend unit shall be securely fastened to a previously prepared sign panel.

**722.04 Basis of Payment.** Demountable sign legend characters, arrows, symbols, and route shields will be paid for at the contract unit price per each for DEMOUNTABLE LEGEND CHARACTERS AND ARROWS. Borders, diagonals, periods, commas, hyphens, and apostrophes will not be paid for separately.

Auxiliary panels will be paid for according to Article 721.05.

### **SECTION 723. INSTALL EXISTING SIGN PANEL**

**723.01 Description.** This work shall consist of installing an existing sign panel on a previously erected sign support(s) or sign structure.

#### **CONSTRUCTION REQUIREMENTS**

**723.02 General.** The existing sign panel shall be transported by the Contractor to the location specified in the contract and installed on the previously erected sign support(s) or sign structure according to the details shown in the plans or as directed by the Engineer.

**723.03 Method of Measurement.** This work will be measured for payment in square feet (square meters) according to Article 720.03.

**723.04 Basis of Payment.** This work will be paid for at the contract unit price per square foot (square meter) for INSTALL EXISTING SIGN PANEL.

### **SECTION 724. REMOVE AND RELOCATE SIGN PANEL AND SIGN PANEL ASSEMBLY**

**724.01 Description.** This work shall consist of removing and relocating sign panels and sign panel assemblies with their supports.

**724.02 Backfill.** All holes left from the removal of supports shall be backfilled with suitable material approved by the Engineer. The surface of the filled hole shall be treated to match the surrounding area.

**724.03 Removal.** Removal shall be as follows.

- (a) Sign Panel Assembly. The sign panel assembly shall be removed from the posts, the supporting channels and the entire support(s) shall be completely removed, and all items transported to the location specified in the contract. When the existing sign panel assembly to be removed is to be replaced by a new sign panel assembly, the new assembly shall be completely installed prior to removal of the existing assembly. Duplicate assemblies shall not exist for periods in excess of 24 hours
- (b) Sign Panels. The sign panel shall be removed completely, including all hardware, and transported to the location specified in the contract.

Art. 724.04 Remove and Relocate Sign Panel and Sign Panel Assembly

**724.04 Relocate.** Relocation of sign panel assemblies and sign panels shall be as follows.

- (a) Sign Panel Assembly. The sign panel assembly and supporting channels shall be installed or reinstalled on new sign supports using new mounting hardware according to the details shown in the plans. In no case shall the time between the removal of an existing sign panel assembly and its reinstallation be in excess of 45 minutes.
- (b) Sign Panel. The sign panel shall be installed or reinstalled on previously erected sign supports or a sign structure using new mounting hardware according to the details shown in the plans or as directed by the Engineer. Any new sign support brackets or redrilling of existing brackets shall be provided when necessary. In no case shall the time between the removal of an existing sign panel and its reinstallation be in excess of two hours, unless authorized in writing by the Engineer.

**724.05 State Furnished Signs.** When signs are specified to be furnished on the project by the State, the signs will be made available to the Contractor's office upon written request. These signs will be delivered within one week of request and, upon delivery, will become the responsibility of the Contractor.

**724.06 Method of Measurement.** Sign Panel removal and relocating will be measured for payment in square feet (square meters) according to Article 720.03.

**724.07 Basis of Payment.** This work will be paid for at the contract unit price per each for REMOVE SIGN PANEL ASSEMBLY, of the type specified; and RELOCATE SIGN PANEL ASSEMBLY, of the type specified; and at the contract unit price per square foot (square meter) for REMOVE SIGN PANEL, of the type specified; and RELOCATE SIGN PANEL, of the type specified.

**SECTION 725. OBJECT MARKER**

**725.01 Description.** This work shall consist of furnishing and installing an object marker Type 1, Type 2, or Type 3 on a previously erected support.

**725.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Acrylic Plastic Prismatic Center-Mount Reflectors (Note 1) .....	1097.03
(b) Sign Base .....	1090
(c) Sign Face .....	1091

Note 1. Used on Type 1 or Type 2 object markers.

**725.03 Basis of Payment.** This work will be paid for at the contract unit price per each for OBJECT MARKER - TYPE 1, TYPE 2, or TYPE 3.

**SECTION 726. MILE POST MARKER ASSEMBLY**

**726.01 Description.** This work shall consist of furnishing and installing a milepost marker at the location specified in the plans.

**726.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Sign Legend, Type 1 .....	1092
(b) Metal Posts and Hardware for Highway Markers, Signs, and Delineators .....	1006.29
(c) Sign Face .....	1091

**726.03 Basis of Payment.** This work will be paid for at the contract unit price per each for MILE POST MARKER ASSEMBLY.

**SECTION 727. SIGN SUPPORT – BREAKAWAY**

**727.01 Description.** This work shall consist of furnishing and installing galvanized structural steel breakaway sign supports or galvanized hollow structural steel tubular breakaway sign supports and stub posts.

**727.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Structural Steel .....	1006.04
(b) Structural Steel Supports .....	1093.01
(c) High Strength Steel Bolts, Nuts and Washers .....	1006.08(b)

Hollow structural steel tubing shall be according to ASTM A 500 (Grade B) or ASTM A 501.

All other structural steel shapes and plates shall be according to AASHTO M 270 (M 270M).

Shims shall be fabricated from stainless steel shim stock according to ASTM A 240 (A 240M), Type 302 or 304.

**CONSTRUCTION REQUIREMENTS**

**727.03 General.** Sign locations shall be staked by the Contractor and approved by the Engineer prior to installation of sign supports and structures.

The Contractor and the Engineer together shall determine the exact lengths required before ordering the supports to be fabricated.

Breakaway sign posts and breakaway tubular sign posts shall be according to the plans, and the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

The steel sign supports shall be fabricated and inspected according to Articles 505.03 through 505.05.

All fabrication shall be completed and ready for assembly before galvanizing. No punching or drilling shall be permitted after galvanizing.

The slot and 5/8 in. (16 mm) diameter hole in the web and the fuse plate bolt holes in the flange shall be made before galvanizing. The post flange shall be saw cut after galvanizing and bare metal surfaces shall be coated with an approved zinc solder or zinc-rich paint. These surfaces shall not be coated until the fuse plate is installed and all bolts fully tightened.

After fabrication, the post, fuse plate, base plate, and upper 6 in. (150 mm) minimum of the stub post shall be galvanized by the hot-dip process according to AASHTO M 111.

The sign supports shall be erected in a vertical position on stub posts previously cast into the foundations. The faces of the supports shall be flush with the sign throughout the contact area. The supports shall be plumbed and brought to final grade.

The top of the supports shall be set within 2 in. (50 mm) of, but not above, the top of the sign when installed at the height specified. When two or more sign supports are required for any sign, the supports shall be erected parallel to each other.

Shims may be used between the plates to level posts.

Posts shall be assembled to stubs with high strength bolts and washers as detailed on the plans.

The bolts in the base plate shall be tightened in a systematic order to the required torque.

Each bolt shall be loosened and tightened to the required torque in the same order as the initial tightening.

Threads at the junction of the bolt and nut shall be burred or center punched to prevent the nut from loosening.

**727.04 Welding.** All welding shall be continuous and according to Article 505.04(q).

**727.05 Tightening.** All friction fuse bolts shall be tightened in the shop as approved by the Engineer and according to the current Specifications of Structural Joints using AASHTO M 164 (M 164M) bolts and one of the following methods.

- (1) Turn-of-Nut Tightening
- (2) Tightening by use of a Direct Tension Indicator

Tightening shall obtain the following minimum residual tension on each bolt.

Min. Residual Bolt Tension		Min. Residual Bolt Tension	
Bolt Dia.	lb (kN)	Bolt Dia.	lb (kN)
1/2 in. (M12)	12,050 (54)	7/8 in. (M22)	39,250 (175)
5/8 in. (M16)	19,200 (85)	1 in. (M24)	51,500 (229)
3/4 in. (M20)	28,400 (126)	1 1/8 in. (M27)	56,450 (251)
		1 1/4 in. (M30)	71,700 (319)

**727.06 Foundations.** Sign support foundations shall be cast-in-place according to Section 503.

**727.07 Method of Measurement.** This work will be measured for payment in pounds (kilograms) of structural steel sign support erected in place.

The measurement of the structural steel shall be computed on the basis of the weight (mass) per foot (meter) of the support, multiplied by the combined length of the main posts and stub posts.

The measurement of the tubular steel shall be computed on the basis of the Post Weight (Mass) Calibration Table shown on the plans for the main posts installed, plus the weight (mass) of the stub posts.

No allowance will be made for the weight (mass) of the welds, either shop or field, and for the galvanizing. No deduction will be made for cuts, copes, or holes.

**727.08 Basis of Payment.** This work will be paid for at the contract unit price per pound (kilogram) for STRUCTURAL STEEL SIGN SUPPORT-BREAKAWAY or TUBULAR STEEL SIGN SUPPORT-BREAKAWAY.

Concrete foundations will be paid for according to Article 734.05

**SECTION 728. TELESCOPING STEEL SIGN SUPPORT**

**728.01 Description.** This work shall consist of furnishing and installing telescoping steel sign supports for ground-mounted signs utilizing a telescoping base section or a previously installed cast iron base.

**728.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Structural Steel Supports, Telescoping .....	1093.01(c)

**CONSTRUCTION REQUIREMENTS**

**728.03 General.** The estimated length of a support includes the total length of all required sections. When two or more posts support the same sign, they shall be erected parallel to each other with the tops of the posts at the same elevation.

The sign locations shall be staked by the Contractor and approved by the Engineer prior to installation of the posts. The Contractor shall be responsible for the proper elevation, offset, and orientation of all signs as indicated in the plans or as directed by the Engineer.

When the support specified is too long, the Contractor may choose to cut the top section or telescope the top section farther into the base section. Any section cut shall have the cut end completely deburred.

When signs are to be placed on adjacent post sides and the posts have holes in only two opposite sides, the Contractor shall drill any additional holes necessary to the tolerances according to Article 1093.01(c).

The top section may be spliced. Splicing shall be done according to the plans and will only be permitted in the upper third of the top section. Only one splice per support will be permitted. The internal splice member shall be 1 3/4 x 1 3/4 in. (45 x 45 mm).

**728.04 Installation Methods.** Installation methods shall be as follows.

- (a) **Pavement Mount.** Pavement mounted installation shall be used only in paved areas and shall consist of three sections as shown in the plans. The base sections may be installed before or after the paving operation, except a hole no greater than 6 in. (150 mm) in diameter shall be cut in the pavement.

Any pavement removed shall be neatly replaced around the base section with like material to the depth of the original pavement.

The 2 1/4 x 2 1/4 in. (57 x 57 mm) base section shall be driven by hand or mechanical means to a minimum depth of 34 in. (850 mm) measured from the pavement surface. The top of the base section shall be protected by a suitable driving cap. When required by the Engineer, the earth around the support shall be compacted after driving.

The sleeve section shall be telescoped over the base section or may be driven with the base section as a unit. The tops of both sections shall be at the same elevation, with the bolt holes aligned.

The 2 x 2 in. (50 x 50 mm) top section shall be telescoped into the base section a minimum of 8 in. (200 mm) and a maximum of 12 in. (300 mm) and the three sections fastened together as shown in the plans.

- (b) **Ground Mount.** Ground mounted installations shall consist of two sections as shown in the plans. The 2 1/4 x 2 1/4 in. (57 x 57 mm) base section shall be driven by hand or mechanical means to a minimum depth of 5 ft (1.5 m) measured from the ground line or as shown in the plans. The top of the base section shall be protected by a suitable driving cap. When required by the Engineer, the earth around the support shall be compacted after driving.

The 2 x 2 in. (50 x 50 mm) top section shall be telescoped into the base section a minimum of 8 in. (200 mm) and a maximum of 12 in. (300 mm) and the two sections fastened together as shown in the plans.

- (c) Base Casting. Base casting shall consist of two sections as shown in the plans. The base section shall be 2 1/4 x 2 1/4 x 8 1/2 in. (57 x 57 x 216 mm). This section shall be inserted at least 6 3/4 in. (170 mm) into the base casting to form a shim into which the 2 in. (50 mm) section is placed. The top section shall be inserted at least 6 3/4 in. (170 mm) into the base casting. After the top section is in place, the installation shall be bolted together as shown in the plans.

**728.05 Method of Measurement.** This work will be measured for payment in feet (meters). The length measured will be the total length of all sections installed, except for any internal splice members and any telescoping of a top section more than 12 in. (300 mm) into a base section.

**728.06 Basis of Payment.** This work will be paid for at the contract unit price per foot (meter) for TELESCOPING STEEL SIGN SUPPORT.

Payment for the base casting will be made according to Section 731.

**SECTION 729. METAL POST**

**729.01 Description.** This work shall consist of furnishing Type A and/or Type B metal posts, and installing them utilizing the direct burial method.

**729.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Metal Post .....	1006.29

**CONSTRUCTION REQUIREMENTS**

**729.03 General.** The metal posts may be driven by hand or mechanical means to a minimum depth of 3.5 ft (1.0 m) for Type A or 4.0 ft (1.2 m) for Type B. The depths shall be measured from the ground line. The post shall be protected by a suitable driving cap and when required by the Engineer, the material around the post shall be compacted after driving.

Scratching, chipping, or other damage to the posts shall be avoided during handling and installation. If chips and/or scratches occur, the areas shall be recoated in the field by a method meeting the coating manufacturer's recommendations. Chips and scratches totaling more than five percent of the surface area of any one post and/or more than five percent of the surface area in any 1 ft (300 mm) segment of any one post shall be cause for rejection of the post.

When the post specified is too long, the Contractor may choose to cut the post to the required length or increase the embedment. Any post cut shall be installed with the cut end at the bottom.

**729.04 Method of Measurement.** The metal post will be measured for payment in feet (meters). The length to be measured shall be the total length installed as shown on the plans.

**729.05 Basis of Payment.** This work will be paid for at the contract unit price per foot (meter) for METAL POST - TYPE A or TYPE B.

**SECTION 730. WOOD SIGN SUPPORT**

**730.01 Description.** This work shall consist of furnishing and installing wood sign supports for ground-mounted signs.

**730.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Coarse Aggregate .....	1004.05
(b) Wood Sign Support .....	1007.05

**CONSTRUCTION REQUIREMENTS**

**730.03 General.** The support shall be modified to satisfy the breakaway requirements by drilling 1 1/2 in. (38 mm) diameter holes centered at 4 and 18 in. (100 and 450 mm) above the groundline and perpendicular to the centerline of the roadway.

When the support is too long, the Contractor may choose to dig the hole deeper or to cut the support to the required length. All cut ends shall become the tops of the supports, and shall be treated with a mixture of not less than five percent pentachlorophenol and petroleum solvent before the signs are mounted.

**730.04 Installation.** The support shall be installed in a vertical hole not exceeding 12 in. (300 mm) in diameter, and not less than 5 ft (1.5 m) deep. The support shall be centered in the hole with the 6 in. (150 mm) dimension parallel to the adjacent edge of pavement. The hole shall then be backfilled with CA 6, thoroughly tamped in 12 in. (300 mm) lifts.

At least 14 days after placing the sign assembly on the post, the Contractor shall inspect each installation, straightening and retamping around each post as required.

**730.05 Method of Measurement.** This work will be measured for payment in feet (meters). The length to be measured will be the total length installed. Any embedment over 6 in. (150 mm) beyond that shown in the plans will not be included for measurement.

**730.06 Basis of Payment.** This work will be paid for at the contract unit price per foot (meter) for WOOD SIGN SUPPORT.

**SECTION 731. BASE FOR TELESCOPING STEEL SIGN SUPPORT**

**731.01 Description.** This work shall consist of furnishing and installing a base for a telescoping steel sign support.

**731.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Base for Telescoping Sign Support .....	1093.02
(b) Hardware (Note 1) .....	1006.29(d)

Note 1. The anchor bolts, nuts, and washers shall be stainless steel.

**731.03 Method of Measurement.** Each base will be measured for payment as an individual unit complete in place.

**731.04 Basis of Payment.** This work will be paid for at the contract unit price per each for BASE FOR TELESCOPING STEEL SIGN SUPPORT.

**SECTION 732. RESERVED****SECTION 733. OVERHEAD SIGN STRUCTURES**

**733.01 Description.** This work shall consist of fabricating, furnishing, and erecting overhead sign structures, including supports, on previously prepared foundations.

**733.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) High Strength Steel Bolts, Nuts, and Washers .....	1006.08(b)
(b) Fabric Bearing Pads .....	1082.01
(c) Overhead Sign Structures .....	1094

**CONSTRUCTION REQUIREMENTS**

**733.03 Drawings.** Two sets of shop fabrication drawings for each overhead sign structure shall be submitted to the Engineer for approval according to Article 505.03.

**733.04 Fabrication.** Structural steel shall be fabricated and inspected according to the applicable portions of Articles 505.04 and 505.05. Aluminum shall be fabricated according to Article 1094.05 and the following.

Materials shall be sawed or milled. Thermal cutting will not be permitted. Holes in extruded alloys shall be drilled. All holes in castings shall be cored and reamed for final fit. All holes in forgings shall be drilled from solid or formed and reamed for final fit. In handling aluminum materials in the shop and in the field, every precaution shall be taken to avoid scoring and marring of the surfaces. Any such scoring or marring

of the surfaces, sufficient in the opinion of the Engineer to give an objectionable appearance, shall be cause for rejection of material. Cast or forged parts shall have all fins or other irregularities removed. Tubing shall be seamless and uniform in quality and temper. Exterior and interior surfaces shall be clean, smooth, and free from seams, slivers, laminations, grooves, cracks, or other defects.

**733.05 Surface Treatment of Structural Steel Supports.** Structural steel supports shall be hot dipped galvanized according to AASHTO M 111 after fabrication is completed.

**733.06 Erection.** Erection of all structural steel and structural aluminum shall be according to the applicable requirements of Article 505.08. High strength bolts, nuts, and washers shall be assembled and tightened according to Article 505.04(f)(3).

**733.07 Wire Cloth.** The void between the base plate and the foundation shall be enclosed according to the following requirements.

A stainless steel mesh 1/4 in. (6 mm) maximum opening with a minimum wire diameter of AWG No. 16 (1.5 mm) with a minimum 2 in. (50 mm) lap shall be installed to enclose the void between the base plate and the foundation. The stainless steel screen wire shall be formed to the shape of the base plate and fastened to the base plate with 3/4 in. (19 mm) stainless steel banding. The screen wire shall overlap and be fastened with a ring type connection.

**733.08 Field Painting.** Field painting for all exposed steel surfaces not galvanized shall be done according to the plans and the requirements of the latest paint system provisions for structural steel.

**733.09 Method of Measurement.** This work will be measured for payment as follows.

- (a) Sign Structure - Span, Monotube, Cantilever, or Butterfly. Span and monotube sign structures will be measured for payment in feet (meters) from center to center of supports. Cantilever and butterfly sign structures will be measured for payment in feet (meters) from end of the unsupported end(s) to center of the support as shown on the plans. Measurement will include the end supports. For steel or aluminum, three dimensional space frame trusses, measurement will include the truss inspection grating inside the truss.
- (b) Sign Structure - Bridge Mounted. Bridge mounted overhead sign structures will be measured for payment in feet (meters) of the overall length of the walkway.
- (c) Sign Structure Walkway. The sign structure walkway will be measured for payment in feet (meters) of the overall length of the walkway, end to end.

**733.10 Basis of Payment.** This work will be paid for at the contract unit price per foot (meter) for OVERHEAD SIGN STRUCTURE - SPAN, OVERHEAD SIGN STRUCTURE - CANTILEVER, OVERHEAD SIGN STRUCTURE - BUTTERFLY, OVERHEAD SIGN STRUCTURE - MONOTUBE, or OVERHEAD SIGN

STRUCTURE - WALKWAY, of the type specified; or OVERHEAD SIGN STRUCTURE - BRIDGE MOUNTED.

### SECTION 734. CONCRETE FOUNDATIONS FOR SIGN STRUCTURES

**734.01 Description.** This work shall consist of constructing a foundation for structural steel sign supports and overhead sign structures.

**734.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement Concrete .....	1020
(b) Grounding Electrodes .....	1087.01(b)
(c) Anchor Rods .....	1094.02
(d) Reinforcement Bars .....	1006.10(a)

### CONSTRUCTION REQUIREMENTS

**734.03 Installation.** Concrete foundations of the type and size specified in the plans, shall be constructed according to the applicable requirements of Section 503 and the following.

Grounding electrodes shall be installed according to Section 806.

The anchor rods shall be firmly held in position by a template during the placing of the concrete.

- (a) Spread Footing for Overhead Sign Structures. The footings shall be constructed according to the applicable requirements of Article 503.13. Conduit, when specified, shall be installed rigidly in place before the concrete is deposited. The top 4 in. (100 mm) of backfill material shall be topsoil suitable for seeding.

Backfill shall be placed around the footing prior to raising the structural steel support frames. It shall be placed in 4 in. (100 mm) lifts and shall be compacted to not less than 90 percent of the standard laboratory density according to AASHTO T 99 (Method C). Care shall be taken to prevent damage to the concrete. Backfill shall be brought level to the finished ground line. All areas disturbed by the Contractor's operations shall be seeded according to Section 250.

The top of the footing shall be finished level, and all exposed surfaces shall be finished according to Article 503.15(a).

- (b) Drilled Shaft Foundations for Overhead Sign Structures. Drilled shaft foundations shall be according to Section 516 and the following.

When obstructions are encountered, the Contractor shall request to relocate the foundation. Any abandoned holes shall be backfilled to the satisfaction of the Engineer.

- (c) Concrete Foundations for Ground-Mounted Sign Supports. The top segment of these foundations shall be finished according to Article 503.15(a) and formed down to a depth of at least 1 ft (300 mm) below the ground line, and the concrete shall be finished level at the ground line.

Concrete shall be cured before sign supports and overhead sign structures are installed.

**734.04 Method of Measurement.** This item will be measured for payment according to Article 503.21.

Excavation in rock will be measured for payment according to Article 502.12.

**734.05 Basis of Payment.** This work will be paid for at the contract unit price per cubic yard (cubic meter) for CONCRETE FOUNDATIONS, or DRILLED SHAFT CONCRETE FOUNDATIONS.

Excavation in rock will be paid for according to Article 502.13.

Obstruction mitigation or abandoned foundation excavations and backfill will be paid for according to Article 109.04.

### **SECTION 735. RELOCATE OVERHEAD SIGN STRUCTURE OR GROUND MOUNTED SIGN SUPPORT**

**735.01 Description.** This work shall consist of removing a span, monotube or cantilever overhead sign structure complete with support(s) and/or a ground mounted sign support, and installing it at another location using either the existing supports or new supports.

**735.02 Relocation.** The new foundation shall be constructed according to Section 734, and the old foundation shall be removed according to Section 737.

- (a) Overhead Sign Structure. The complete horizontal section of the overhead sign structure shall be removed from the support(s) and the support(s) removed from the foundation(s). The complete overhead sign structure shall then be transported to its new location and erected according to Section 733, using new nuts and washers on the foundation(s).
- (b) Ground Mounted Sign Supports. Each support shall be removed from the foundation, transported to its new location, and erected on a foundation.

All materials required for erecting the relocated support, such as mounting hardware, shims, etc., shall be considered as part of the support.

**735.03 Basis of Payment.** This work will be paid for at the contract unit price per each for RELOCATE OVERHEAD SIGN STRUCTURE - SPAN or CANTILEVER, RELOCATE MONOTUBE OVERHEAD SIGN STRUCTURE - SPAN or CANTILEVER, or RELOCATE GROUND MOUNTED SIGN SUPPORT.

**SECTION 736. REMOVE OVERHEAD SIGN STRUCTURE**

**736.01 Description.** This work shall consist of removing a span, monotube, cantilever, or bridge-mounted overhead sign structure.

**736.02 Removal.** The entire overhead sign structure, including sign panels and sign lighting, is to be removed from the right-of-way. The removed structure shall be disposed of according to the contract.

Concrete foundations shall be removed according to Section 737.

**736.03 Basis of Payment.** This work will be paid for at the contract unit price per each for REMOVE OVERHEAD SIGN STRUCTURE - SPAN or CANTILEVER, REMOVE OVERHEAD SIGN STRUCTURE, MONOTUBE - SPAN or CANTILEVER, or REMOVE OVERHEAD SIGN STRUCTURE - BRIDGE MOUNTED.

**SECTION 737. REMOVE GROUND MOUNTED SIGN SUPPORT AND/OR CONCRETE FOUNDATIONS**

**737.01 Description.** This work shall consist of removing a ground-mounted sign support and/or concrete foundations.

**737.02 Removal.** Removal of ground mounted sign supports and/or concrete foundations shall be as follows.

- (a) **Ground Mounted Sign Support.** The ground mounted sign support is to be completely removed from the right-of-way within 24 hours after removal of the sign panel. The removed support shall become the property of the Contractor.

Sign panels shall be removed according to Section 724.

- (b) **Concrete Foundations.** All components of the concrete foundation, including the concrete, reinforcing, stub post, and electrical items, shall be removed at least 1 ft (300 mm) below the ground line.

The use of explosives of any kind will not be permitted in removing concrete foundations.

The hole shall be backfilled with suitable material approved by the Engineer. The surface of the filled hole shall be treated to match the surrounding area.

All debris resulting from this operation shall be removed from the right-of-way.

Concrete foundations for overhead sign structures shall be removed within five calendar days after the removal of the overhead sign structure.

**737.03 Basis of Payment.** This work will be paid for at the contract unit price per each for REMOVE GROUND MOUNTED SIGN SUPPORT and/or REMOVE CONCRETE FOUNDATION - GROUND MOUNT or OVERHEAD.

**SECTION 738. REMOVE, REPLACE, AND REERECT OVERHEAD SIGN STRUCTURE - SPAN, MONOTUBE, OR CANTILEVER**

**738.01 Description.** This work shall consist of removing a sign structure, replacing damaged components, and reerecting the overhead sign structure.

**738.02 Materials.** Drawings, fabrication, welding of structural steel, surface treatment of structural steel supports, erection, wire cloth, galvanizing and the replacement of nuts, bolts, and washers shall be according to the applicable portions of Section 733.

**738.03 Removal.** Removal of structural steel supports and/or overhead sign structures shall be as follows.

- (a) Structural Steel Support. The damaged structural steel end support shall be removed, replaced, and moved from the right-of-way. The support shall become the property of the Contractor. Any salvage value shall be reflected in the bid price. This work shall also include the removal of an existing sign panel, if one is present, and reinstallation of the same sign panel on the new end support, and the installation of a sign structure number as directed by the Engineer.
- (b) Overhead Sign Structure. The Contractor shall remove the entire overhead sign structure, including sign panels, sign lighting, or walkway from its support(s) and properly anchor the structure on blocks. The entire overhead sign structure shall be reerected when the structure is reattached to the supports including the replacement of any damaged hardware.

Saddle shim blocks and fabric pads shall remain in their proper position during reerection.

The district where this work is being performed shall be responsible for disconnecting the sign lighting prior to removal of the overhead structure and reconnecting the sign lighting after the overhead structure has been reerected.

**738.04 Basis of Payment.** This work will be paid for at the contract unit price per each for STRUCTURAL STEEL SUPPORT FOR OVERHEAD SIGN STRUCTURE - SPAN or CANTILEVER. Removing and reerecting the overhead sign structure will be paid at the contract unit price per each for REMOVE AND REERECT OVERHEAD SIGN STRUCTURE-SPAN or CANTILEVER.

**PAVEMENT MARKING**

**SECTION 780. PAVEMENT STRIPING**

**780.01 Description.** This work shall consist of furnishing and applying pavement marking.

**780.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Thermoplastic Pavement Markings .....	1095.01
(b) Paint Pavement Markings .....	1095.02
(c) Prefomed Plastic Pavement Markings .....	1095.03
(d) Epoxy Pavement Marking .....	1095.04
(e) Prefomed Thermoplastic Pavement Marking .....	1095.05
(f) Glass Beads for Pavement Markings .....	1095.07

**780.03 Equipment.** Equipment shall be according to the following.

Item	Article/Section
(a) Thermoplastic Truck-Mounted (Note 1) .....	1105.01(a)
(b) Thermoplastic Hand-Operated (Note 1) .....	1105.01(b)
(c) Epoxy .....	1105.02

Note 1. A mechanical beader approved by the Engineer shall be used.

**CONSTRUCTION REQUIREMENTS**

**780.04 General.** Thermoplastic and epoxy pavement markings shall only be applied by Contractors on the list of Approved Contractors maintained by the Engineer of Operations and in effect on the date of advertisement for bids.

Pavement marking on freeways shall be placed with truck-mounted equipment. Markings on roads other than freeways may be placed with either truck-mounted or hand-operated equipment.

Before applying the pavement marking material, the pavement shall be clean, dry, and free of debris or any other material that would reduce the adhesion of the markings on the pavement.

The edge of a center line or lane line shall be offset a minimum distance of 2 in. (50 mm) from a longitudinal crack or joint. Edge lines shall be approximately 2 in. (50 mm) from the edge of pavement. The finished center and lane lines shall be straight, with the lateral deviation of any 10 ft (3 m) line 1 in. (25 mm) or less.

Pavement marking words and symbols shall conform closely to the dimensions and spacing specified in the MUTCD and the plans. Deviations from the required dimensions and spacing or other departures from reasonable standards of professionalism will be cause for rejection by the Engineer.

The words and symbols shall be as specified in Table 1 in Article 780.12.

**780.05 Thermoplastic.** Prior to applying the thermoplastic pavement markings, the existing pavement markings shall be removed. The area removed shall be no wider than the width of the existing pavement markings. The new thermoplastic pavement markings shall be applied over the location where the pavement markings were removed.

The Contractor shall notify the Engineer 72 hours prior to the placement of the thermoplastic markings. At the time of this notification, the Contractor shall indicate the manufacturer and lot numbers of thermoplastic and glass beads he/she intends to use.

The compound shall be installed in a molten state at a minimum temperature of 400 °F (205 °C) and maximum temperature of 475 °F (245 °C). Scorching or discoloration of material will be cause for rejection by the Engineer. The machinery shall be constructed so all mixing and conveying parts, up to and including the shaping-die, maintain the material in a molten state.

Thermoplastic shall be applied only when the pavement temperature is 55 °F (13 °C) or greater and no later than November 1 or earlier than April 15. If the thermoplastic markings cannot be placed according to these specifications and the road is to be opened to traffic between November 1 and April 15 and no adequate pavement markings are in place, the Contractor shall, at the direction of the Engineer, place temporary pavement markings according to Section 703. The Contractor shall remove the temporary pavement markings and place the thermoplastic pavement markings on or after April 15 or as agreed upon by the Engineer.

A binder sealer shall be applied on all hot-mix asphalt (HMA) pavements over 60 days old and on all portland cement concrete pavement surfaces where the new thermoplastic material is to be installed. The binder sealer material shall be applied as recommended by the manufacturer of the thermoplastic and in sufficient quantities to entirely cover the surface on which the thermoplastic is to be laid.

The thermoplastic material shall be applied at a thickness of not less than 100 mils (2.50 mm) but no greater than 110 mils (2.75 mm). Finished lines shall be within 1/4 in. (6 mm) of the width specified in the plans.

Thermoplastic markings shall be placed with drop on glass beads according to Article 1095.01, uniformly applied to assure adequate nighttime reflectivity. It shall be the Contractor's responsibility to use a compatible combination of thermoplastic material and beads to preclude the surface beads from sinking deeply into the thermoplastic.

The thickness of the markings will be measured above the pavement surface at random points as selected by the Engineer, to determine conformance.

- (a) If the measurements show less than 100 mils (2.50 mm), the Engineer will "chip" the edges of the markings at random points and measure the thickness of the chips to determine if the overall thickness of the markings is at least 100 mils (2.50 mm). When either the overall thickness or the

thickness above the pavement surface is substantially in conformance with the thickness requirements, payment will be made at 100 percent of the contract unit prices involved.

- (b) If the thickness at a given location is less than 100 mils (2.50 mm), additional measurements will be taken on each side of the location by the Engineer to determine the extent of the deficient portion of the marking. If the average thickness of the deficient portion is less than 100 mils (2.50 mm) but more than 60 mils (1.50 mm), an adjusted unit price of 50 percent of the contract unit price involved will be used in computing payment for the area which is deficient.
- (c) If the measurements show the average thickness to be less than 60 mils (1.50 mm), the Contractor shall remove the surface of the deficient portions of the markings sufficiently to reduce the average thickness to approximately 50 mils (1.25 mm) or less. The Contractor shall then apply additional thermoplastic material and beads to bring the thickness of the markings to at least 100 mils (2.50 mm) and the reflectivity to the minimum required values.

**780.06 Paint.** Prior to application of the paint pavement marking, the Contractor shall make certain the pavement surface is dry and free of dirt or grease and, if necessary, clean the surface to the satisfaction of the Engineer.

Paint shall not be applied at air temperatures below 50 °F (10 °C), unless approved by the Engineer.

The paint shall be applied at a minimum thickness of 16 mils (406 µm) and beads shall be applied to all painted surfaces at the minimum rate of 6.0 lb/gal (720 g/L) of paint used.

**780.07 Preformed Plastic.** The markings shall be capable of being applied on either new HMA surfaces by being inlaid into the surface, or on new and existing portland cement concrete and HMA surfaces, by means of a pressure-sensitive, precoated adhesive, or liquid contact cement which shall be applied at the time of installation.

The pavement shall be cleaned as recommended by the manufacturer.

Cleaning operations shall not begin until a minimum of 30 days after the placement of new portland cement concrete pavement.

The cleaning operation shall remove all visible evidence of curing compound on the peaks and valleys of textured concrete surfaces, remove all loose and flaking material, and round any sharp edges and irregularities.

When recommended by the manufacturer, a primer sealer shall be applied on all pavement surfaces where new preformed plastic pavement marking material is to be applied. The primer sealer shall be recommended by the manufacturer of the preformed plastic pavement material and shall be compatible with the material being used. The primer sealer shall be applied in sufficient quantities to entirely cover the pavement surface where the plastic material is to be placed. The Contractor shall not

install the preformed plastic pavement markings until the primer sealer dries according to the manufacturer's recommendations.

The markings placed on the pavement shall be rolled and compacted onto the pavement with a roller or tamper cart approved by the manufacturer. This roller shall be loaded with or weigh at least 200 lb (90 kg). The Contractor shall tamp and roll the material sufficiently to prevent easy removal or peeling. Care shall be taken to cut the material in and around pavement joints or cracks and roll the material into the cracks of joints.

- (a) Type B - Inlaid Application. On freshly placed HMA, the inlaid markings shall be applied before final compaction and when the pavement temperature has cooled to approximately 150 °F (65 °C) and when, in the opinion of the Engineer, the pavement is acceptable for vehicular traffic.

The markings shall be applied at a minimum thickness of 60 mils (1.5 mm).

The markings shall be placed on the pavement by means of a mechanical applicator or by a hand method and embedded into the pavement surface with a static compaction roller with minimum water on the roller.

The initial rolling of the markings shall be in the same direction as the application to minimize buckling in front of the roller. The roller shall not be allowed to turn on the markings.

The markings shall be embedded to a depth of approximately 0.04 in. (1.0 mm).

- (b) Type B or C - Standard Application. The material shall be applied only when the air temperature is 60 °F (15 °C) or above and rising and the pavement temperature is 70 °F (21 °C) or greater. However, standard application of preformed plastic pavement markings will not be allowed after October 15.

When the preformed plastic markings cannot be placed according to these specifications and the road is to be opened to traffic after October 15 with no adequate pavement markings in place, the Contractor shall place preformed tape for lane lines. All other pavement markings shall be placed according to Article 703.05. The Contractor shall then place the preformed pavement markings on or as soon after April 15 as the requirements of these specifications can be met

**780.08 Preformed Thermoplastic.** The pavement markings shall be capable of being applied on either HMA or portland cement concrete surfaces by using a propane blowtorch.

A primer sealer recommended by the manufacturer of the preformed pavement marking material shall be applied on portland cement concrete surfaces prior to application of the preformed thermoplastic pavement marking material. The primer sealer material shall be applied in sufficient quantities to entirely cover the pavement surface where the pavement marking material is to be placed.

The pavement temperature and the ambient air temperature shall be at or above 32 °F (0 °C) at the time of installation of the pavement markings.

**780.09 Epoxy.** The pavement shall be cleaned by a method approved by the Engineer to remove all dirt, grease, glaze, or any other material that would reduce the adhesion of the markings with minimum or no damage to the pavement surface. New portland cement concrete pavements shall be blast-cleaned to remove all latents.

Markings shall be applied to the cleaned surface on the same calendar day. If this cannot be accomplished, the surface area shall be recleaned prior to applying the markings. No markings shall be placed until the Engineer approves the cleaning.

Widths, lengths, and shapes of the cleaned surface shall be of sufficient size to include the full area of the specified pavement marking to be placed or removed.

The cleaning operation shall be a continuous moving process with minimum interruption to any traffic.

The material shall be applied to the cleaned road surface at 20 mils  $\pm$  1 mil (0.51 mm  $\pm$  0.03 mm) in thickness, before the glass beads are applied. Glass beads shall be uniformly applied by means of a double drop pressurized bead applicator system. The system shall apply both the first drop glass beads and the second drop glass beads at a rate of 10 lb/gal (1.2 kg/L). Epoxy pavement marking shall be applied only when the air and surface temperatures are a minimum of 35 °F (2 °C) and rising. Where epoxy markings cannot be placed according to these specifications and the road is open to traffic with no adequate pavement markings in place, the Contractor shall place temporary pavement markings according to Article 703.05.

Lane lines shall be applied within four calendar days after removal of any existing lane lines.

The Contractor shall provide the Engineer an accurate temperature measuring device(s) which shall be capable of measuring the pavement temperature prior to the application of the material, the material temperature at the gun tip, and the material temperature prior to mixing.

The Contractor may use preformed plastic pavement marking or thermoplastic pavement marking, meeting the applicable requirements of Sections 1095 and 780, for diagonal lines, stop bars, and letters and symbols in lieu of epoxy at no additional cost to the Department.

**780.10 Inspection.** The epoxy, thermoplastic, preformed thermoplastic, and preformed plastic Type B or C, pavement markings will be inspected following installation, but no later than October 15 for preformed plastic markings, November 1 for thermoplastic and preformed thermoplastic markings, and December 15 for epoxy markings. In addition, they will be inspected following a winter performance period that extends 180 days from November 1.

Within 15 calendar days after the end of the winter performance period, a final performance inspection will be made. Final acceptance requirements are as follows.

- (a) Lane lines: 90 percent intact by area of each individual dashed line segment.
- (b) Crosswalks, stop lines, arrows, and words: 90 percent intact by area of each individual line, symbol, or letter.
- (c) Center lines, edge lines, gore markings, and channelizing lines: 90 percent intact by area measured over any 10 ft (3 m) length of any individual line regardless of width.
- (d) Entire project: measured in its entirety according to (a), (b), and (c) above, the entire project shall be 95 percent intact.

Upon completion of the final performance inspection, or after satisfactory completion of any necessary correction, the Engineer will notify the Contractor, in writing, of the date of such final performance inspection and release him/her from further performance responsibility.

If this inspection discloses any work, in whole or in part, which does not meet the inspection requirements, the Contractor shall, within 30 calendar days, completely repair or replace such work to the satisfaction of the Engineer.

This performance inspection and performance acceptance of the epoxy, thermoplastic, preformed thermoplastic, and preformed plastic Type B and C pavement markings shall not delay acceptance of the entire project and final payment due if the Contractor requires and receives from the subcontractor a third party "performance" bond naming the Department as obligee in the full amount of all pavement marking quantities listed in the contract, multiplied by the contract unit price. The bond shall be executed prior to acceptance and final payment of the non-pavement marking items and shall be in full force and effect until final performance inspection and performance acceptance of the epoxy, thermoplastic, preformed thermoplastic, and preformed plastic pavement markings. Execution of the third party bond shall be the option of the Contractor.

**780.11 Method of Measurement.** This work will be measured for payment as follows.

- (a) Contract Quantities. The requirements for the use of contract quantities shall be according to Article 202.07(a).
- (b) Measured Quantities. Lines will be measured for payment in place in feet (meters). Double yellow lines will be measured as two separate lines.

Words and symbols shall conform to the sizes and dimensions specified in the Illinois Manual on Uniform Traffic Control Devices and Standard 780001 and will be measured based on the total areas indicated in Table 1 or as specified in the plans.

**780.12 Basis of Payment.** This work will be paid for at the contract unit prices per foot (meter) of applied line width, as specified, for THERMOPLASTIC PAVEMENT MARKING - LINE; PAINT PAVEMENT MARKING - LINE; EPOXY PAVEMENT MARKING - LINE; PREFORMED PLASTIC PAVEMENT MARKING - LINE - TYPE B, C, or B - INLAID; PREFORMED THERMOPLASTIC PAVEMENT MARKING - LINE; and/or per square foot (square meter) for THERMOPLASTIC PAVEMENT MARKING - LETTERS AND SYMBOLS; PAINT PAVEMENT MARKING - LETTERS AND SYMBOLS; EPOXY PAVEMENT MARKING - LETTERS AND SYMBOLS; PREFORMED PLASTIC PAVEMENT MARKING - TYPE B, C, or B - INLAID - LETTERS AND SYMBOLS; PREFORMED THERMOPLASTIC PAVEMENT MARKING - LETTERS AND SYMBOLS.

When the Contractor has the option of applying Permanent Pavement Marking it shall be Thermoplastic, Preformed Plastic (Type B, C, or B - Inlaid), Epoxy, or Preformed Thermoplastic Pavement Markings. It will be paid for at the contract unit price per foot (meter) of applied line for PERMANENT PAVEMENT MARKING - LINE 4 (100), 5 (125), 6 (150), 8 (200), 12 (300), 16 (400), or 24 in. (600 mm) and per square foot (square meter) for PERMANENT PAVEMENT MARKING - LETTERS AND SYMBOLS.

Temporary pavement markings placed in lieu of permanent will be paid for according to Article 703.07.

\*TABLE 1

LETTERS  
sq ft (sq m)

Size	A	B	C	D	E	F	G	H	I
6 ft (1.8 m)	3.1 (0.28)	4.0 (0.37)	2.7 (0.25)	3.4 (0.31)	3.3 (0.31)	2.6 (0.24)	3.3 (0.31)	3.4 (0.31)	1.5 (0.14)
8 ft (2.4 m)	5.5 (0.51)	7.1 (0.66)	4.8 (0.45)	6.1 (0.57)	5.9 (0.55)	4.7 (0.44)	5.8 (0.54)	6.0 (0.56)	2.6 (0.24)

Size	J	K	L	M	N	O	P	Q	R
6 ft (1.8 m)	2.1 (0.2)	3.1 (0.28)	2.2 (0.20)	4.2 (0.39)	4.0 (0.37)	3.4 (0.31)	3.0 (0.28)	3.6 (0.33)	3.6 (0.33)
8 ft (2.4 m)	3.7 (0.34)	5.7 (0.53)	3.8 (0.45)	7.4 (0.69)	7.1 (0.65)	6.0 (0.56)	5.3 (0.49)	6.3 (0.59)	6.3 (0.59)

Size	S	T	U	V	W	X	Y	Z
6 ft (1.8 m)	3.2 (0.30)	2.2 (0.20)	3.2 (0.30)	2.7 (0.25)	4.2 (0.39)	2.7 (0.25)	2.2 (0.20)	2.9 (0.26)
8 ft (2.4 m)	5.7 (0.53)	3.8 (0.35)	5.6 (0.52)	4.8 (0.45)	7.3 (0.68)	4.8 (0.45)	3.9 (0.36)	5.1 (0.47)

NUMBERS  
sq ft (sq m)

Size	1	2	3	4	5
6 ft (1.8 m)	1.5 (0.14)	3.3 (0.31)	3.3 (0.31)	2.9 (0.26)	3.5 (0.33)
8 ft (2.4 m)	2.6 (0.24)	5.8 (0.54)	5.8 (0.54)	5.1 (0.47)	6.1 (0.57)

Size	6	7	8	9	0
6 ft (1.8 m)	3.5 (0.33)	2.2 (0.20)	3.8 (0.35)	3.5 (0.33)	3.4 (0.31)
8 ft (2.4 m)	6.2 (0.58)	3.8 (0.35)	6.7 (0.62)	6.2 (0.58)	6.0 (0.56)

SYMBOLS  
sq ft (sq m)

Symbol	Large Size	Small Size
Through Arrow	11.5 (1.07)	6.5 (0.60)
Left or Right Arrow	15.6 (1.47)	8.8 (0.82)
2 Arrow Combination Left (or Right) and Through	26.0 (2.42)	14.7 (1.37)
3 Arrow Combination Left, Right, and Through	38.4 (3.56)	20.9 (1.94)
Lane Drop Arrow	41.5 (3.86)	--
Wrong Way Arrow	24.3 (2.26)	--
Railroad "R" 6 ft (1.8 m)	3.6 (0.33)	--
Railroad "X" 20 ft (6.1 m)	54.0 (5.02)	--
Handicapped Symbol	4.6 (0.43)	--

\*Table applies to all types of pavement marking materials.

**SECTION 781. RAISED REFLECTIVE PAVEMENT MARKERS**

**781.01 Description.** This work shall consist of placing permanent and/or temporary raised reflective pavement markers or replacing the reflective element in a raised reflective pavement marker.

**781.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Raised Reflective Pavement Markers .....	1096.01
(b) Temporary Raised Reflective Pavement Markers .....	1096.02

**CONSTRUCTION REQUIREMENTS**

**781.03 General.** The reflector may be attached to the casting prior to or after the placement of the markers. The depression in the web shall be clean and dry. The reflector shall be laminated to an elastomeric pad and adhesively attached to the casting. The protective paper or plastic film covering the adhesive pad shall be removed immediately prior to placing the reflector on the casting. Once the film covering is removed, extreme care shall be taken to avoid contamination of the exposed pad surface. An adhesive meeting the marker manufacturer's specifications shall be used. The adhesive shall be placed either on the reflector or on the web in sufficient quantity so as to ensure complete coverage of the contact area with no voids present and with a slight excess after the reflector is pressed in place.

- (a) Permanent. It shall be the Contractor's responsibility to determine the location of any traffic control devices installed in the pavement before beginning work, and shall conduct work to avoid damage to these devices. Any damage to these devices caused by the Contractor's operation shall be repaired.

The pavement shall be cut to match the bottom contour of the marker using a concrete saw fitted with 18 and 10 in. (450 and 250 mm) diameter blades. Diamond blades shall be used on portland cement concrete pavement. The cut shall be clean and completely dry prior to pouring the epoxy. After the cut is cleaned, the configuration shall be checked using a pavement marker. The marker shall fit easily within the cut with the leveling tabs resting on the pavement. If any force is required to place or remove the marker or if the leveling tabs do not rest on the pavement surface, the cut shall be enlarged as necessary. Installations on crowned pavements, super elevations, or ramps shall be cut deeper than those on level pavements if necessary to get proper marker fit. A rapid setting (hard in one hour) epoxy meeting the requirements of AASHTO M 237 shall be poured into the cut to within 3/8 in. (9 mm) of the pavement surface. The installed height for the reflective pavement markers shall be approximately 0.3 in. (7.5 mm) above the road surface.

The marker shall then be placed into the epoxy-filled cut. The leveling tabs shall rest on the pavement surface and the marker tips shall be slightly below the pavement surface when properly installed. There shall be no

epoxy on the reflective lens. The epoxy, when properly mixed, shall be hard cured in 30-45 minutes. If after one hour, a screwdriver or other appointed instrument can be pushed into the epoxy, the marker and the uncured epoxy shall be removed, and the marker shall be cleaned and the unit reinstalled.

The pavement surface temperature and the ambient air temperature shall be at or above 50 °F (10 °C) at the time of installation of the marker for the epoxy adhesive to properly cure.

Unless directed by the Engineer, raised reflective pavement markers shall not be laid directly over a longitudinal crack or joint. The edge of a raised reflective pavement marker shall be offset, toward traffic, a minimum distance of 2 in. (50 mm) from the edge of pavement, a longitudinal crack or joint, or a solid lane line. Raised reflective pavement markers shall be centered in the gap between dashed line segments and the finished line of the markers shall be straight. The lateral deviation on any 10 ft (3 m) line shall not exceed 1 in. (25 mm). Raised reflective pavement markers through tangents of reverse curves which are less than 500 ft (150 m) in length shall be installed at the lesser of the two curve spacings.

The reflectors may be attached to the castings either prior to or after the placement of the markers. The depression in the web shall be clean and dry. The reflector shall be placed on the casting with sufficient pressure to firmly seat it in place, minimum load of 100 lb (45 kg). Adhesive material shall not be permitted on the reflective surface of the prismatic reflector.

- (b) Temporary. The pavement surface which the marker shall be bonded to, shall be free of dirt, curing compound, grease, oil, moisture, or any other material which would adversely affect the bond of the adhesive.

The markers shall be placed firmly on the pavement and pressed into place by slowly passing over them with a truck wheel. The pass shall not displace the markers. In lieu of an adhesive pad, an adhesive meeting the marker manufacturer's specifications may be used. The adhesive shall be placed either on the reflector or on the web in sufficient quantity so as to ensure complete coverage of the contact area with no voids present and with a slight excess after the reflector is pressed in place.

All markers shall be monodirectional. Markers placed to the left of traffic shall be amber and markers placed to the right of traffic shall be crystal.

- (c) Replacement. All remaining portions of the existing reflector, and all traces of adhesive, rust, dirt, etc., shall be removed from the marker reflector area by sandblasting or other methods approved by the Engineer.

The Contractor shall be responsible for verifying the model numbers of castings as shown on the plans and shall be responsible for installing the proper replacement reflector in each casting.

The Contractor shall make certain the casting surface is dry and free of dirt and rust prior to placing the reflector on the casting.

The reflector shall be placed on the casting with sufficient pressure to firmly seat it in place, minimum load of 100 lb (45 kg). Adhesive material shall not be permitted on the reflective surface of the prismatic reflector. The pavement surface temperature and the ambient air temperature shall be at or above 50 °F (10 °C) at the time of application of the prismatic reflector.

**781.04 Inspection of Raised Reflective Pavement Markers.** The permanent raised reflective pavement marker and/or replacement reflector will be inspected following installation, but no later than November 30. In addition, they will be inspected following a winter performance period that will extend 180 days from November 30.

Within 15 calendar days after the end of the winter performance period, a final performance inspection will be made. If this inspection discloses any work which is not visibly intact and serviceable, the Contractor shall, within 30 calendar days, completely repair or replace such work to the satisfaction of the Engineer.

Measured in its entirety, the work shall be 97 percent intact.

Upon completion of the final performance inspection or after satisfactory completion of any necessary corrections, the Engineer shall notify the Contractor in writing of the date of such final performance inspection and release him/her from further performance responsibility.

This delay in performance inspection and performance acceptance of the raised reflective pavement markers shall not delay acceptance of the entire project and final payment due if the Contractor requires and receives from the subcontractor a third party "performance" bond naming the Department as obligee in the full amount of all raised reflective pavement marker quantities listed in the contract, multiplied by the contract unit price. The bond shall be executed prior to acceptance and final pavement of the nonraised reflective pavement marker items and shall be in full force and effect until final performance inspection and performance acceptance of the raised reflective pavement markers. Execution of the third party bond shall be the option of the prime Contractor.

**781.05 Basis of Payment.** This work will be paid for at the contract unit price per each for RAISED REFLECTIVE PAVEMENT MARKER, RAISED REFLECTIVE PAVEMENT MARKER (BRIDGE), TEMPORARY RAISED REFLECTIVE PAVEMENT MARKER, or REPLACEMENT REFLECTOR.

**SECTION 782. PRISMATIC REFLECTORS**

**782.01 Description.** This work shall consist of furnishing and installing prismatic reflectors on concrete barriers, bridge parapet walls, and mountable or barrier curbs.

**782.02 Materials.** Materials shall be according to the following.

Item	Article/Section
(a) Prismatic Barrier Reflectors .....	1097
(b) Prismatic Curb Reflectors .....	1097

**CONSTRUCTION REQUIREMENTS**

**782.03 General.** The surface of the barrier, bridge parapet wall or curb to which the reflector shall be applied shall be free of dirt, curing compound, moisture, paint, or any other material which would adversely affect the bond of the adhesive. Cleaning of the surface shall be to the satisfaction of the Engineer.

An adhesive meeting the reflector manufacturer's specifications shall be placed either on the surface or the bottom of the reflector in sufficient quantity to ensure complete coverage of the contact area with no voids present and with a slight excess after the reflector is pressed firmly in place.

**782.04 Basis of Payment.** This work will be paid for at the contract unit price per each for MONODIRECTIONAL or BIDIRECTIONAL, PRISMATIC BARRIER REFLECTOR, and PRISMATIC CURB REFLECTOR. Where bidirectional units (two reflective surfaces) are specified, the Contractor may, at no extra cost to the Department, furnish two separate monodirectional units (single reflective surface) and mount them back to back.

**SECTION 783. PAVEMENT MARKING AND MARKER REMOVAL**

**783.01 Description.** This work shall consist of removing existing pavement markings and raised reflective pavement markers.

**783.02 Equipment.** Equipment shall be according to the following.

Item	Article/Section
(a) Portable Shot Blast Equipment .....	1101.13
(b) Grinders (Note 1)	

Note 1. Grinding equipment shall be approved by the Engineer.

**CONSTRUCTION REQUIREMENTS**

**783.03 Removal of Conflicting Markings.** Existing pavement markings that conflict with revised traffic patterns shall be removed as directed by the Engineer and

shall be scheduled immediately to facilitate a change in lane assignments which requires removal of conflicting markings. If darkness or inclement weather prohibits the removal operations, such operations shall be resumed the next morning or when weather permits. In the event of removal equipment failure, such equipment shall be repaired, replaced, or leased so removal operations can be resumed within 24 hours.

- (a) **Pavement Markings.** The existing pavement markings shall be removed from the pavement by a method that does not materially damage the surface or texture of the pavement or surfacing. Very small particles of tightly adhering existing markings may remain in place, if in the opinion of the Engineer, complete removal of the small particles will result in pavement surface damage. Any damage to the pavement or surfacing caused by pavement marking removal shall be repaired by methods acceptable to the Engineer.

The shape of the obliterated strip shall be disguised so the pattern of the removed marking is not retained. Where mechanical means of marking removal have been employed, flat paint of a color matching the pavement surface or an asphaltic seal coat may be used if necessary as a means of covering contrasting pavement texture. The use of flat paint to cover conflicting pavement markings will not be allowed.

- (b) **Pavement Markers.** The removal of existing markers shall consist of the reflective element and the base casting complete. On those improvements where no pavement rehabilitation is required, the pavement shall be repaired with material according to Article 406.05 to the satisfaction of the Engineer.

When permanent raised reflective pavement markers are present and conflict with the revised traffic patterns, only the reflectors shall be removed.

**783.04 Cleaning.** The roadway surface shall be cleaned of debris, blast sand, or any other deleterious material by the use of compressed air, water blast, or shotblast. When the shotblast method is used, the steel shot shall be collected.

Over cleaning to the extent of possible damage to the roadway surface shall be held to a minimum.

**783.05 Method of Measurement.** This work will be measured for payment as follows.

- (a) **Contract Quantities.** The requirement for use of contract quantities shall be according to Article 202.07(a).
- (b) **Measured Quantities.** The existing pavement marking removal will be measured in square feet (square meters). All existing lines, letters, and symbols will be measured in square feet (square meters).

**783.06 Basis of Payment.** This work will be paid for at the contract unit price per each for RAISED REFLECTIVE PAVEMENT MARKER REMOVAL, or at the contract unit price per square foot (square meter) for PAVEMENT MARKING REMOVAL.