

SUPPLEMENTAL SPECIFICATIONS
INDIANA DEPARTMENT OF TRANSPORTATION
1999 STANDARD SPECIFICATIONS

REVISION TO 1999 STANDARD SPECIFICATIONS

SECTION 901, BEGIN LINE 174, DELETE AS FOLLOWS:

On days when fly ash is being accumulated for use as a pozzolan, the supplier shall obtain a minimum of one sample per day and furnish test results for moisture content, loss on ignition, sulfur trioxide and 45 :m (No. 325) sieve residue for each sample. ~~A specific gravity determination shall be performed on at least one sample per week.~~

SECTION 904, AFTER LINE 121, INSERT AS FOLLOWS:

Specific Gravity and Absorption, Fine Aggregate.....AASHTO T 84

SECTION 904, BEGIN LINE 285, DELETE AND INSERT AS FOLLOWS:

(d) Surface Aggregate Requirements. The surface aggregate selection shall be based on the ESAL loadings for the project as following:

COARSE AGGREGATE TYPES FOR HMA SURFACE MIXTURES			
<i>(Note 1)</i>			
Coarse Aggregate Type	Traffic ESAL		
	< 1,000,000	< 3,000,000	≥ 3,000,000
Air-Cooled Blast Furnace Slag	Yes	Yes	Yes
Steel Furnace Slag	Yes	Yes	Yes
Sandstone	Yes	Yes	Yes
Crushed Dolomite	Yes	Yes	Note 1 2
Crushed Stone	Yes	No	No
Gravel	Yes	No	No

Note 1. Coarse aggregate for HMA shoulder surface mixtures may be any of the coarse aggregate types.

Note: 12. ~~Dolomite may only be used when blended equally with slag or sandstone. A maximum of 50% of coarse aggregate may be dolomite.~~

SECTION 904, BEGIN LINE 290p DELETE AND INSERT AS FOLLOWS:

75 :m (No. 200)(2)								5.0-10.0	5.0-10.0 12.0	
Decant Conc ⁽³⁾			0-1.5	0-1.5	0-1.5	0-1.5				0-1.5
Other	0-1.0	0-2.5	0-2.5	0-3.0	0-2.5	0-2.5	0-2.0			0-2.5

- NOTES: 1. The fraction passing the 75 μm (No. 200) sieve shall not exceed 2/3 the fraction passing the 600 μm (No. 30) sieve. The liquid limit shall not exceed 25 (35 if slag) and the plasticity index shall not exceed 5. The liquid limit shall be determined in accordance with AASHTO T 89 and the plasticity index in accordance with AASHTO T 90. ~~Unless otherwise specified, when these materials are not to be surfaced or sealed under the contract, the amount passing the 75 μm (No. 200) sieve shall be 5% to 12% and the plasticity index shall not exceed 7.~~
2. Includes the total amount passing the 75 μm (No. 200) sieve as determined by AASHTO T 11 and T 27.
3. When the material is stone or slag, the decant may be 0 to 2.5.

SECTION 910, BEGIN LINE 859, DELETE AND INSERT AS FOLLOWS:

(e) Square Steel Posts. *Square steel sign post shall be covered by the type of certification specified in the Frequency Manual and A-type C certification shall be required in accordance with 916.*

SECTION 910, AFTER LINE 874, DELETE AND INSERT AS FOLLOWS:

- c. *ASTM A 653, cold rolled high strength steel, 1.90 mm (0.75 in.) with minimum yield strength of 414 MPa (60,000 psi). The ultimate tensile strength shall not exceed 550 MPa (79,800 psi) or have an elongation measured over 50 mm (2 in.) greater than 20%. This requirement shall apply to the 50 mm x 50 mm (2 in. x 2 in.) size posts only.*

Yield strengths and chemical composition shall be determined from the three latest test results performed by the steel manufacturer. These test results may not be determined on materials from which the delivered posts were made. However, the tests shall have been performed within 90 days of shipment. The certification shall include the range of test results and the section modulus value in accordance with 910.14(a)3.

2. Fabrication. The posts shall be corner welded and scarfed as necessary to allow sections to telescope within each other. *The finished posts shall be machine straightened and have a smooth uniform finish free from cracks, flaws, injurious seams, laps, blisters, and edges which are ragged, sharp, and imperfect, or other defects affecting their strength, durability, or appearance. The maximum variation in straightness shall be no more than 6.3 mm (1/4 in.) in any 1.52 m (5 ft.) of length. Cut holes or knockout holes of 11 mm (7/16 in.) diameter shall be spaced on 25 mm (1 in.) centers, on the centerlines of all four sides in true alignment, and opposite to each other for back to back applications. All holes and sheared ends shall be free from burrs.*

3. Protective Coating. The protective coating shall be applied using one of the following:

- a. ~~Both inside and outside surfaces shall be galvanized or coated in accordance with ASTM A 525.~~ *Before fabrication, both sides of the rolled sheet steel shall be galvanized in accordance with ASTM A 653M, coating designation Z 275 (ASTM A 653, coating designation G 90).*

- b. After fabrication, a triple coating system ~~with a zinc coating on the outside of the posts consisting of galvanizing with zinc which is in accordance with AASHTO M 120, weighing 190 mL/m^2 $183 \pm 46 \text{ g/m}^2$ ($0.60 \pm 0.15 \text{ oz/ft}^2$) shall be applied to the outside of the post,~~ followed by a chromate conversion coating ~~of $0.02 \text{ } \mu\text{g/mm}^2$ weighing $0.02 \pm 0.006 \text{ g/m}^2$ (15 ± 5 micrograms per $\mu\text{g/in.}^2$)~~ and a clear organic exterior coating ~~of $5 \text{ } \mu\text{m}$ with a dry film thickness of $5 \pm 2.5 \text{ } \mu\text{m}$ ($0.2 \pm 0.1 \text{ mil}$).~~ The interior surface of the posts shall receive a double in-line application of a full zinc based rich organic coating ~~of $30 \text{ } \mu\text{m}$ with a total dry film thickness of $30 \pm 15 \text{ } \mu\text{m}$ ($1.2 \pm 0.6 \text{ mil}$).~~ Such interior coating shall be tested in accordance ~~with ASTM B 117.~~ The dried zinc rich organic coating film shall contain a minimum of 77% total zinc. Samples from the posts which use these protective coatings shall be exposed to salt fog testing in accordance with ASTM B 117 for a total of 500 h. The samples shall be examined at both 100 and 500 h of salt fog testing and rated for corrosion. At 100 h the corrosion rating shall be a minimum of 9 and at 500 h the corrosion rating shall be a minimum of 6 when determined in accordance with ASTM D 1654.

(f) Portable Construction Sign Trailer. The portable construction sign trailer, not including the signs and lights, shall weigh no more than 140 kg (300 lb) and shall not be fabricated with heavier than 75 x 75 mm (3 x 3 in.) angles, 63 mm (2 1/2 in.) pipe, or 75 x 50 mm (3 x 2 in.) rectangular tubing. The rim size of the wheels shall not exceed 300 mm (12 in.). Axle assemblies with differential housings shall not be used.

SECTION 912, AFTER LINE 24, INSERT AS FOLLOWS:

(f) Polyethylene Film. The sheeting shall be in accordance with AASHTO M 171.

SECTION 913, BEGIN LINE 31, DELETE AND INSERT AS FOLLOWS:

913.04 Hydrated Lime. Hydrated Lime shall be in accordance with ASTM C 207, Type N a hydrated lime when used in masonry or a hydrated lime, quicklime or lime by-product when used for soil modification.

(a) Hydrated Lime for Masonry. Hydrated lime used in masonry shall be in accordance with ASTM C 207, Type N.

(b) Lime for Soil Modification.

1. Hydrated Lime and Quicklime. Hydrated lime and quicklime shall be in accordance with AASHTO M 216.

2. Lime By-Products. Lime by-products shall be hydrated lime or quicklime by-products in accordance with ASTM C 25 having the following requirements:

- a. The lime by-products shall contain a minimum of 60% total available calcium and magnesium oxides (non-volatile basis).
- b. Available calcium hydroxide plus magnesium oxide calculated as calcium hydroxide shall be a minimum of 30%.
- c. Sieve analysis shall be performed in accordance with ASTM C 110. The lime by-products gradation shall be as follows:

Sieve	% Passing
4.75 mm (No. 4)	95-100
600 μ m (No. 30)	90-95
150 μ m (No. 100)	70-80

SECTION 913, BEGIN LINE 1574, DELETE AND INSERT AS FOLLOWS:

913.12 Construction Warning Lights. Construction warning lights shall be self-illuminated by means of an electric lamp behind the lens. Types A and C shall also be externally illuminated by reflex-reflective elements built into the lens to enable it to be seen by the light from the headlights of oncoming traffic.

The batteries shall be entirely enclosed in a case. The case shall be secured by a locking device which can be opened with a special tool.

~~(a) Types of Warning Lights.~~

~~1. Type A.~~ Type A shall be a low intensity flashing barricade warning light.

~~2. Type B.~~ Type B shall be a high intensity flashing barricade warning light.

~~3. Type C.~~ Type C shall be a steady burn barricade warning light.

~~(b) General Requirements.~~ The light shall be self-illuminated by means of an electric lamp behind the lens. Types A and C also shall be externally illuminated by reflex-reflective elements built into the lens to enable it to be seen by reflex reflection of the light from the headlights of oncoming traffic.

~~When the unit is to be operated by batteries, the batteries shall be entirely enclosed in a case. The case shall be secured by a locking device which can be opened by a special wrench or tool.~~

~~When the unit is to be operated by a 120 volt, 60 cycle power supply, the unit shall be supplied with a separate ground wire and be protected with suitable fuses. The connections and equipment used shall be in accordance with the pertinent current standards of the Institute of Electrical and Electronic Engineers, the ASTM, and the National Board of Fire Underwriters. In those areas where there are pertinent local ordinances and requirements, the wiring, materials, and installation procedures shall be in accordance with them.~~

(e) (a) Flash Requirements.

1. Flash Rate. The light from types A and B shall have a flash rate of 65 ± 10 pulsations per minute from -29°C (-20°F) to $+66^{\circ}\text{C}$ (150°F) ~~regardless of power source.~~

2. On-Time. *On-time is defined as the period of the flash when instantaneous intensity is equal to or greater than the effective intensity as specified in 913.12(b)1.*

~~**a. Definition.** On-time is defined as the period of the flash when instantaneous intensity is equal to or greater than the effective intensity as specified in 913.12(d)1.~~

~~**b a. Type A.** The light shall have an on-time of no less than 10% of the flash cycle.~~

~~**c b. Type B.** The light shall have an on-time of no less than 8% of the flash cycle.~~

(d)(b) Optical Requirements.

1. Effective Intensity. The light beam projected upon a surface perpendicular to the axis of the light beam shall produce a lighted area within the solid angle bounded by the two vertical planes nine degrees from the vertical plane through the axis of the optical system and two planes five degrees above and below the horizontal plane through the optical axis of the system.

For type A, the effective intensity shall not drop below 4.0 cd (4.0 candles) within the area specified herein during the first 336 h of continuous flashing.

For type B, the effective intensity shall not drop below 35 cd (35 candles) within the area specified herein during the first 168 h of continuous flashing.

For type C, the ~~beam-candle power~~ effective intensity shall not drop below 2.0 cd (2.0 candles) within the area specified herein during the first 168 h of continuous burning.

2. Lens Illumination. The illuminated lens shall be uniformly bright in appearance over its entire illuminated surface when viewed from any point within the angle defined in ~~912.12(d)1~~ 913.12(b).

3. Reflex-Reflective Performance. For types A and C the specific intensity of the lens when acting as a reflex-reflector at an observation angle of 0.2 of a degree shall be no less than the following:

Entrance Angle (degrees)	Specific Intensity Candelas per lux (Candles per Footcandle)
0	1.67 (18)
10	1.40 (14)
20	0.65 (7)

4. Testing Procedure. The effective intensity of types A and B lights shall be calculated using the Guide for Calculating the Effective Intensity of flashing Signal Lights as approved by the Illuminating Engineering Society, June, 1961. The intensity of the type C light shall be tested in accordance with SAE Standard J 575d, Lighting Equipment and Photometric Tests. Reflex-reflection shall be tested in accordance with SAE Standard J 594d.

(e)(c) Lens Requirements.

1. Size of Lens. The lens shall be no less than 175 mm (7 in.) in diameter including for ~~types A and C~~ a reflex-reflector ring of 13 mm (1/2 in.) minimum width around the periphery *for types A and C*.

2. Number of Directional Lenses. Unless otherwise directed, types A, B, and C shall have uni-directional lenses.

3. Lens Chromaticity. If the light uses an incandescent lamp, the chromaticity of the lens color shall be defined by the tri-stimulus coordinates of the Commission International d'Eclairage Standards. When tested with illuminants from 2856 K to 2366 K, the lens color shall fall within the area of the chromaticity diagram in accordance with the 1931 Commission International d'Eclairage Standard Observer as defined by the following coordinates:

X	Y	Z
0.543	0.452	0.005
0.548	0.452	0.000
0.584	0.411	0.005
0.589	0.411	0.000

If the light uses other than an incandescent lamp, the light output shall be in the same range as the light obtained with the incandescent lamp and the specific lens.

4. Lens Luminous Transmittance. The minimum relative luminous transmittance of the lens with illuminant at 2856 K shall be 0.440.

5. Lens Material. The lens shall be plastic of one piece construction. ~~The lens material~~ and shall meet the test requirements in accordance with SAE J 576b, except that the exposure time and condition, paragraph 3.4.3, for the purposes of this standard shall be one year.

~~(f)~~(d) Head and Housing Case.

1. Swivel Head. If swivel capabilities as described herein are not incorporated in the device used to mount a type A or C light on a barricade or sign, the head shall be mounted on the housing in a manner permitting it to be swiveled through a minimum 90 degrees arc in a horizontal plane. If swiveling is accomplished by rotation of the head, construction shall be such that the head rotation ~~will~~ *shall* not damage the wiring.

2. Housing. ~~Housing shall be the case containing the batteries and circuitry. The housing shall be constructed of No. 12 mm (18 gage) steel or other approved material.~~

3. Weatherproofing 2. Case. The case shall be so constructed and closed as to exclude moisture that would affect the specified operation of the light. The case shall have a weep hole to allow the escape of moisture from condensation.

~~(g)~~(e) Photoelectric Controls. Photoelectric controls, if provided on types A or C lights, shall keep the light operating whenever the ambient light falls below 215 lux (20 footcandles).

~~(h) Basis For Use.~~ ~~A type C certification in accordance with 916 shall be provided for construction warning lights, except it shall be prepared by the Contractor, and not a manufacturer.~~

SECTION 913, DELETE LINES 1724 THROUGH 1729.

SECTION 913, AFTER LINE 1730, INSERT AS FOLLOWS:

An indicator light shall be provided on the back of the sign to provide confirmation that the flashing arrow sign is operating. The indicator light shall be visible for 150 m (500 ft).

(a) Solar Powered. *Solar power assisted units shall incorporate a target sight device and leveling mechanism to aid the user for positioning of the unit prior to use. The device shall be attached to the elevated portion of the flashing arrow sign and not to the fixed support frame.*

The lamps shall be electronically operated by means of a solid state controller. An automatic lamp intensity regulator shall hold the lamp output constant with varying battery voltage. The control system shall incorporate a full time tracking system designed to track ambient light for 24 h a day. The control system shall adjust lamp intensity to provide maximum system efficiency. The controller shall be in a weatherproof, ventilated, lockable enclosure.

The lamps shall provide amber beams with a minimum of a 20° horizontal and 6° vertical field of view. The minimum effective luminance within the required beam shall not be less than one half the effective luminance at the beam center.

The battery bank shall consist of 12 v, deep cycle, batteries. The battery bank shall be of sufficient capacity to power the unit for 15 days with no assistance from the sun. A battery condition indicator and a test switch shall be provided to monitor the system's battery charge. The batteries shall be secured in a well-ventilated, weatherproof lockable housing. A low battery charge indicator which shall be visible to maintenance personnel driving past the sign shall be provided to indicate the need to recharge the batteries. The battery bank shall be at full charge when delivered to the project site.

The unit shall be equipped with a sign/solar panel lifting mechanism. The lifting mechanism shall be designed to safely carry the capacity of the sign's load. The lifting mechanism shall incorporate a positive locking device to secure the panel in a raised or lowered position.

Solar power assisted flashing arrow signs to be used shall be selected from the Department's list of Approved Solar Power Traffic Control Devices.

(b) Diesel Powered. *Flashing arrow sign shall be fueled by diesel fuel only.*

(c) AC Powered. *When connected to an AC electrical power source, provisions shall be made to prevent electrocution.*

FLASHING ARROW SIGN GENERAL SPECIFICATIONS

	TYPE A	TYPE B	TYPE C	SOLAR POWER ASSISTED
Minimum Board Size	0.6 m (2 ft) high x 1.2 m (4 ft) wide**	See Note Below	1.2 m (4 ft) high x 2.4 m (8 ft) wide	1.2 m (4 ft) high x 2.4 m (8 ft) wide
Minimum No. of Lamps Flashing Arrow Flashing Double Arrow Sequential Chevron (3 Heads Minimum)	5 in head, 5 in shaft* 5 in head, 4 in shaft* 5 in head		Same as Type A	5 in head, 5 in shaft* 5 in head, 3 in shaft* 7 in shaft
Lamp Type	Sealed Beam - 12.8 V, not to exceed 3 A Ave. rated life - 300 h. Min. Candlepower - 1000 cd (1000 candles) Min. 9700 cd (9700 candles) Max.		Same as Type A	Sealed beam - 12.8 V, not to exceed 3 A Average rated life - 300 h Min. Candlepower - 600 cd (600 candles) at normal voltage and ≥ 250 cd (250 candles) at low voltage
Lens Color	Amber		Amber	Amber
Board Color	Flat Black		Flat Black	Flat Black
Flashing Rate	30-50 F.P.M. (50% on time)		30-50 F.P.M. (50 % on time)	25-40 F.P.M. (50% on time)
Message (Left or Right)	Flashing Arrow, Flashing Double Arrow, or Sequential Chevron		Flashing Arrow, Flashing Double Arrow	Flashing Arrow, Flashing Double Arrow, or Warning Bar
Minimum mounting height (to bottom of board)	2.1 m (7 ft)		2.1 m (7 ft)	2.1 m (7 ft)
Where Permitted	Where normal speed limit is less than 40 mph		All rural & urban locations	Stationary Operations Tangent Sections (See 801.13(a))
Required Minimum Visibility	0.8 km (0.5 mi)		1.6 km (1 mi)	1.6 km (1 mi)

* When flashing a single or double arrow(s), the lamp(s) nearest the arrow points shall not be illuminated.

** Either rectangular or arrow shaped black background sign will be permitted.

Note: General specifications for a type B flashing arrow sign are shown in the Federal MUTCD.

913.13.1 Temporary Worksite Speed Limit Sign Assembly. *The temporary worksite speed limit sign assembly shall be an all-weather, self-contained unit designed to display speed limit signs in accordance with the MUTCD and as shown on the plans. The signs shall be installed on frangible posts or mounted on movable stands or trailers in accordance with 910.14(f). The power source shall be capable of operating the strobe lights, without service, for the period which the sign is in effect. An on/off switch will be required.*

SECTION 913, BEGIN LINE 2022, DELETE AND INSERT AS FOLLOWS:

Type I tape shall be prequalified for use. ~~and each~~ Each manufacturer shall provide the ~~Procurement and Distribution~~ Operations Support Division with samples for field evaluation. The Department will maintain a list of approved type I tape.