INDIANA DEPARTMENT OF TRANSPORTATION

STANDARDS COMMITTEE MEETING

Driving Indiana's Economic Growth

REVISED AGENDA

December 17, 2009 Standards Committee Meeting

(Item No.02 11/19/09 (2010 SS) and Item No.03 11/19/09 (2010 SS) have been added for consideration.
Changes and corrections are shown highlighted in yellow.)

MEMORANDUM

December 04, 2009

TO: Standards Committee

FROM: Lana Podorvanova

RE: Revised Agenda for the December 17, 2009 Standards Committee Meeting

A Standards Committee meeting is scheduled for 9:00 a.m. on December 17, 2009 in the N955 Bay Window Conference Room. Please enter the meeting thorough the double doors directly in front of the conference room. The following agenda items are listed for consideration.

A. GENERAL BUSINESS ITEMS

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

1. Approval of the November 19, 2009 Minutes

B. CONCEPTUAL PROPOSAL ITEMS

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

(No items on this agenda)

Page No.

C. STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS PROPOSED ITEMS

OLD BUSINESS

Item No. 01 10/15/09 (2010 SS)	Mr. Shields	3
109.05.1	*(f) Pavement Traffic Markings, PMT*	
801.12(a)	Temporary Pavement Marking Methods	
808	PAVEMENT TRAFFIC MARKINGS	
909.05	~~White and Yellow Traffic Paint~~ *Blank*	
921	PAVEMENT MARKING MATERIALS	
IDM 76-3.0	PAVEMENT MARKING MATERIALS	
ITM 931-08T	MEASUREMENT OR RETROREFLECTIVE PAVEMENT MARKING MATERIALS	
Item No. 02 11/19/09 (2010 SS)	Mr. Heustis	60
Section 401.18	Pavement Smoothness	
Section 401.19	Pay Factor	
Item No 03 11/19/09 (2010 SS)	Mr. Heustis	68
Section 501.25	Pavement Smoothness	
Section 501.28	Pay Factor	

NEW BUSINESS

Item No. 01 12/17/09 (2010 SS)	Ms. Rearick	75
731-X-XXX	*STRUCTURE BACKFILL FOR MSE WALL*	
Item No. 02 12/17/09 (2010 SS)	Mr.Wright	78
Standard Drawings:		
802-SBTS-01 thru 08	*SIGN BOX TRUSS STRUCTURE (various)*	
802-SBTS-08A	*SIGN BOX STRUCTURE END SUPPORT*	
802-SBTS-09 thru 19	*SIGN BOX TRUSS STRUCTURE (various)*	
802-BTSF-01 thru 08	*BOX TRUSS STRUCTURE FOUNDATION (various)*	
Item No. 03 12/17/09 (2010 SS)	Mr.Walker	108
401.06	Recycled Materials	
402	HOT MIX ASPHALT, HMA, PAVEMENT	
410.06	Recycled Materials	

cc: Committee Members (11)
FHWA (2)
ICA (1)

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Inconsistent and poor performance of pavement marking materials.

PROPOSED SOLUTION: Adopt a performance based specification for pavement markings. Performance measures will include color, durability, and retained retroreflectivity.

Performance based specifications allow a wider range of materials to be used, so modifications to 921 were needed. Retroreflectivity testing required a modification to ITM 931. IDM 76-3.0 requires minor revision to accommodate the new 808.

RSP 808-R-551 (performance based markings) can be deleted, and RSP 808-T-141 (RPM's) has been incorporated into the new proposal.

APPLICABLE STANDARD SPECIFICATIONS: 808, 909.05, 921

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: 76-3

APPLICABLE SECTION OF GIFE: Unknown

APPLICABLE RECURRING SPECIAL PROVISIONS: 808-R-551, 808-T-141

Submitted By: Todd Shields

Title: Manager, Office of Technical Services

Organization: INDOT

Phone Number: 317-233-4726

Date: November 24, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? Ad-hoc (Joe Novak, Dana Plattner, Todd Tracy, Ting Nahrwald, Carl Tuttle (retired), Todd Shields); reviewed by District Traffic Engineers and material suppliers (3M, Brightline, Epoplex)

Item No. 01 10/15/09 (2010 SS)
Mr. Shields
Date: 12/17/09

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 109.05.1: QUALITY ADJUSTMENTS

SECTION 109.05.1, AFTER LINE 808, INSERT AS FOLLOWS:

(f) Pavement Traffic Markings, PTM

Quality adjustments will be calculated in accordance with 808.07

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 801.12(a): TEMPORARY PAVEMENT TRAFFIC METHODS

SECTION 801.12(a), AFTER LINE 601, INSERT AS FOLLOWS:

(a) Temporary Pavement Marking Methods

Pavement markings shall be installed in accordance with 808.07 *except that measurement of retro-reflectivity is not required by the Contractor and quality adjustments will not apply. All other performance measures shall apply.*

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS

SECTION 808 – PAVEMENT TRAFFIC MARKINGS

808.01 Description

This work shall consist of furnishing and installing, or removing, pavement traffic markings and snowplowable raised pavement markers in accordance with the MUTCD, these specifications and as shown on the plans. Markings shall be installed as required unless written approval is obtained from the District Traffic Engineer to make modifications at specific locations.

MATERIALS

808.02 Materials

Materials shall be in accordance with the following:

Cones	801.08
~~Epoxy~~ *Multi-Component*	921.02(c)
~~Glass~~ Beads	921.02(e)
Preformed Plastic	921.02(b)
Extended Warranty Preformed Plastic	*921.02(b)*
Snowplowable Raised Pavement Markers	921.02(d)1
Thermoplastic	921.02(a)
~~Traffic Paint~~	~~909.05~~

A certification which shows the paint meets all IDEM and EPA regulatory requirements for VOC levels and lead, chromium or other heavy metals from the paint manufacturer shall be provided.

CONSTRUCTION REQUIREMENTS

808.03 General Requirements

Permanent pavement markings shall be placed on the surface course in a standard pavement marking pattern. Center lines shall be placed on two-way two-lane roads, lane lines shall be placed on multi-lane divided roads, and both center lines and lane lines shall be placed on multi-lane undivided roads. ~~The markings shall be of the same material as the existing pavement markings or any durable pavement marking material.~~

The pavement shall be cleaned of all dirt, oil, grease, excess sealing material, excess pavement marking material and all other foreign material prior to applying new pavement traffic markings. New paint pavement markings may be placed over sound existing markings of the same color. New thermoplastic, preformed plastic, or ~~epoxy~~ *multi-component* markings may be applied over sound existing markings of ~~the same~~ *a compatible* type if permitted by manufacturer's recommendations, a copy of which shall be supplied to the Engineer prior to placement; otherwise, existing markings shall be removed in accordance with 808.10 prior to placement of the new markings. Removal of

pavement marking material shall be in accordance with 808.10. The pavement surface shall be dry prior to applying pavement traffic markings.

Control points required as a guide for pavement traffic markings shall be spotted with paint for the full length of the road to be marked. Control points along tangent sections shall be spaced at a maximum interval of 100 ft (30 m). Control points along curve sections shall be spaced so as to ensure the accurate location of the pavement traffic markings. The location of control points shall be approved prior to the pavement traffic marking application.

808.04 Longitudinal Markings

All longitudinal lines shall be clearly and sharply delineated, straight and true on tangent, and form a smooth curve where required. Lines shall be square at both ends, without mist, drip or spatter.

A solid line shall be continuous. A broken line shall consist of 10 ft (3 m) line segments with 30 ft (9 m) gaps.

All lines shall be gapped at intersections unless otherwise specified or directed.

The actual repainting limits for no-passing zone markings will be determined by the Engineer.

A new broken line placed over an existing broken line shall laterally match the existing broken line, and the new line segments shall not extend longitudinally more than 10% beyond either end of the existing line segments.

(a) Center Lines

Center lines shall be used to separate lanes of traffic moving in opposite directions. All center line markings shall be yellow in color and 4 in. (100 mm) in width. They shall be placed such that the edge of the marking, nearest to the geometric centerline of the roadway, shall be offset 4 in. (100 mm) from the geometric centerline.

The center line of a multi-lane roadway shall be marked with a double solid line. The two lines forming the double solid line shall be spaced 8 in. (200 mm) apart and shall be equally offset on opposite sides of the geometric centerline.

The center line of a 2-lane, 2-way roadway, where passing is allowed in both directions, shall be marked with a broken line.

The center line of a 2-lane, 2-way roadway, where passing is allowed in one direction only, shall be marked with a double line, consisting of a broken line and a solid line. The broken line and the solid line shall be spaced 8 in. (200 mm) apart and shall be equally offset on opposite sides of the geometric centerline. The solid line shall be offset toward

the lane where passing is prohibited. The broken line shall be offset toward the lane where passing is permitted.

(b) Lane Lines

Lane lines shall be used to separate lanes of traffic moving in the same direction. Normal lane line markings shall be white in color and shall be 5 in. (125 mm) wide on freeways, interstates and toll roads, and 4 in. (100 mm) wide on all other roads. They shall be offset 4 in. (100 mm) to the right of longitudinal pavement joints or divisions between traffic lanes. Normal lane lines shall be marked with white broken lines. White solid lines shall be used to mark lane lines only when specified or directed.

(c) Edge Lines

Edge lines shall be used to outline and separate the edge of pavement from the shoulder. Edge line markings shall be 4 in. (100 mm) in width and shall be placed such that the edge of the marking nearest the edge of the pavement shall be offset 4 in. (100 mm) from the edge of the pavement except as otherwise directed. Right edge lines shall be marked with a white solid line and left edge lines shall be marked with a yellow solid line.

(d) Barrier Lines

Barrier lines shall be used as specified or directed. Barrier line markings shall be solid lines of the size and color specified or as directed.

808.05 Transverse Markings

(a) Transverse marking lines shall be used as specified or directed to delineate channelizing lines, stop lines, crosswalk lines, and parking limit lines. The markings shall consist of all necessary lines, of the width specified or directed and shall be in accordance with the MUTCD.

(b) Pavement message marking shall be used as specified or directed for railroad crossing approaches, intersection approaches, crosswalk approaches, handicap parking spaces, and other messages applied to the pavement with pavement marking material. The markings shall consist of all necessary lines, words, and symbols as specified or directed, and shall be in accordance with the MUTCD.

808.06 Curb Markings

Curb markings shall consist of reflectorized paint which shall cover the face and top of the curb. *Center curb painting shall consist of reflectorized paint which shall cover the area of the top of the curb not covered by other curb painting items.* The existing curb and gutter area shall be cleaned of dirt, dust, oil, grease, moisture, curing compound, and unsound layers of other materials before paint is applied to the curb surface.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

808.07 Pavement Marking Material Application and Equipment

All double line markings, such as a no passing zone or the center line of an undivided multi-lane roadway, shall be applied in one pass. *When a hand propelled machine is used, the single pass application of double line markings will not be required and control points shall be spaced at a maximum of 10 ft longitudinally.*

~~Stop lines and crosswalk lines for new or modernized traffic signal installations shall be durable pavement marking material. For this application, preformed plastic may be used on concrete if permitted by manufacturer's recommendations. However, f~~*F*or *new or modernized traffic signal installation* contract*s with* completion dates in winter months when conditions do not permit application of durable markings, traffic paint markings may be substituted with an appropriate unit price adjustment if approved by the Engineer.

Markings shall be installed in accordance with the manufacturer's recommendations, except that the minimum requirements stated herein shall also apply. Products specifically designed for application temperatures below the stated minimums herein are not required but may be used if approved by the Engineer. When directed, the Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals prior to beginning installation work, and no installation work shall begin prior to the Department's receipt of these manuals. These manuals shall become the property of the Department.

The markings shall be protected from traffic until dry to eliminate tracking.

The markings shall meet or exceed the following performance criteria:

a. Color

The daytime and nighttime color of the applied markings shall be in accordance with ASTM D 6628 when determined in accordance with ASTM E 811 and E 1349.

b. Durability

The pavement markings shall have a minimum resistance to wear of 97% in accordance with ASTM D 913.

c. Retro-reflectivity

Contracts with 50,000 lft (15 000 m) or more of longitudinal paint line or 10,000 lft (3 000 m) or more longitudinal durable marking line shall have retro-reflectivity measured. Longitudinal lines shall meet required minimum initial and retained average retro-reflectivity measurements. All other contracts and markings shall meet the required longitudinal line minimum measurements and will be measured by the Department at the discretion of the Engineer, except that quality adjustments will not apply. Retained retro-reflectivity is the value at the time of the warranty expiration in accordance with 808.09 and will be measured by the Department at the discretion of the Engineer.

Retro-reflectivity testing equipment shall be furnished, calibrated, and operated in accordance with ITM 931. The markings shall be tested in a period of not less than 14 days to not more than 30 days after the materials are applied. The retro-reflectivity equipment shall remain the property of the Contractor. The measurement of retro-reflectivity shall be supervised or performed at all times by an operator trained and certified by the unit's manufacturer. A report as described in the ITM and including the specified test results and calculations shall be prepared and provided to the Engineer within 3 days of each day of testing.

Quality adjustments will be applied to the payment of markings which fail to meet the required minimum initial average retro-reflectivity values. The required minimum initial and retained average retro-reflectivity values for longitudinal line measured in mcd/m²/lx are as follows:

Material Type	*White*	*Yellow*	*Quality Adjustment**	*Retained White*	*Retained Yellow*
Paint	*≥ 250*	*≥ 175*	*1.00*	*n/a*	*n/a*
Required Minimum	*150 to 249*	*125 to 174*	*0.70*		
Thermoplastic	*≥ 300*	*≥ 200*	*1.00*	*200*	*150*
Required Minimum	*250 to 299*	*150 to 199*	*0.70*		
Multi-Component	*≥ 300*	*≥ 200*	*1.00*	*200*	*150*
Required Minimum	*250 to 299*	*150 to 199*	*0.70*		
Preformed Plastic	*≥ 300*	*≥ 200*	*1.00*	*200*	*150*
Required Minimum	*250 to 299*	*150 to 199*	*0.70*		
Ext. Warranty Preformed Plastic	*≥ 650*	*≥ 450*	*1.00*	*See 808.09.1*	*See 808.09.1*
Required Minimum	*550 to 649*	*350 to 449*	*0.70*		

**Quality Adjustments do not apply to the retained retro-reflectivity values.*

(a) Traffic Paint

1. Application

~~Standard dry and fast dry traffic paint shall be applied only when the pavement temperature is 40ºF (5ºC) or above.~~

Waterborne traffic paint shall be applied only when the *ambient air and* pavement temperature is 50º F (10ºC) or ~~above~~ *higher and will remain 50º F (10ºC) or higher for two hours after application.* ~~Standard dry or fast dry traffic paint will only be permitted between October 1 and the following April 30.~~ *Traffic paints which are not waterborne shall be applied only when the ambient air and pavement temperature is 40º F (5º C) or higher and will remain 40º F (5ºC) or higher for two hours after application.*

The wet film thickness of the traffic paint shall be a minimum of 15 mils (380 µm). Painted lines and markings shall be immediately reflectorized by applying ~~glass~~ beads at a uniform minimum rate of 6 lb/gal. (0.7 kg/L) of traffic paint. *Only standard or modified standard beads shall be used for paint markings.*

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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

2. Equipment

Traffic paint shall be applied with a spray type machine capable of applying the traffic paint under pressure through a nozzle directly onto the pavement. The *truck-mounted* machine shall be equipped with the following: ~~an air blast device for cleaning the pavement ahead of the painting operation; a guide pointer to keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; paint agitator(s); a control device to maintain uniform flow and application; an automatic device which will provide a broken line of the required length; and an automatic glass bead dispenser which is synchronized with the marking application. When fast drying traffic paint or waterborne traffic paint is used, the machine shall be capable of heating the paint to application temperatures in accordance with 909.05.~~

(1) air blast device for cleaning the pavement ahead of the application;
(2) guide pointer to keep the machine on an accurate line;
(3) spray guns which can be operated individually or simultaneously;
(4) agitator(s) or recirculation system as appropriate;
(5) control device to maintain uniform flow and application;
(6) capability of heating the material to application temperatures;
(7) automatic device which will provide a line of the required pattern; and
(8) automatic bead dispenser which is synchronized with the marking application.

A ~~brush or small~~ hand propelled machine~~, designed for that purpose,~~ may be used ~~if approved~~ to apply some painted markings. *A brush may be used if approved to apply some markings.*

3. Performance Requirements

The color and durability requirements shall be met for a minimum of 90 days after application.

Pavement marking segments which are found to have an average retro-reflectivity reading below the minimum required shall be re-striped with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be re-striped with no additional payment. The re-striping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments may be re-striped with no additional payment. Following each re-striping, additional retro-reflectivity measurements shall be made with no additional payment. Quality adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-striped pavement markings shall be placed within

±0.25 inches in width and ±2.0 inches in length of the original placed markings. Re-striping will not be permitted more than two times.

(b) Durable Pavement Marking Material

Durable pavement marking material consists of thermoplastic, preformed plastic, or ~~epoxy~~ *multi-component markings. After October 31, if the road is open to unrestricted traffic in accordance with 101.33 and all other work is complete except application of durable pavement markings, the contract time will be adjusted if necessary to allow for application of the markings as weather permits after March 31 of the following year.*

1. Thermoplastic

a. Application

~~Thermoplastic marking material shall be used on asphalt pavements unless otherwise specified or directed. The pavement surface shall be primed with a binder material in accordance with the manufacturer's recommendations.~~ Thermoplastic marking shall be applied in molten form by ~~spray,~~ *conventional* extrusion~~, or ribbon type extrusion airless spray~~ when the pavement *and ambient air* temperature*s* ~~is~~ *are* 50°F (10°C) or above*; or by ribbon type extrusion or spray when the pavement and ambient air temperatures are 60°F (16°C) or above*. *Heat bonded preformed thermoplastic may be used for transverse or message markings.* The average *final* thickness of each 36 in. (910 mm) length of thermoplastic marking shall be no less than ~~3/32 in.~~*90 mil* (2.~~5~~*3* mm) nor more than ~~3/16 in.~~*125mil* (~~5~~ *3.2* m*m*). Immediately following the application of the thermoplastic markings, additional *retro*-reflectorization shall be provided by applying ~~glass~~ beads to the surface of the molten material at a uniform minimum rate of ~~6~~*8* lb/100 sq ft (~~2~~*3*.9 kg/10 m^2) of marking. *Individual passes of markings shall not overlap or be separated by gaps greater than 1/4 in (6 mm) longitudinally.*

b. Equipment

The ~~machine~~ *equipment* used for the ~~spray~~ application of thermoplastic markings shall consist of a kettle for melting the material and an applicator for applying the markings. All of the equipment required for ~~preheating~~ *melting* and applying the material shall maintain a uniform material temperature within the *manufacturer* specified limits, without scorching, discoloring or overheating any portion of the material.

~~The~~ *A truck-mounted* machine shall be equipped with the following: an air blast device for cleaning the pavement ahead of the marking operation; a guide pointer to keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; agitators; a control device to maintain uniform flow and application; an automatic device which will provide a broken line of the required length; and an automatic ~~glass~~ bead dispenser which is synchronized with the marking application.

A hand-propelled machine may be used to apply transverse markings and longitudinal markings less than 500ft (152.4m) of continuous length.

The equipment for applying heat bonded preformed plastic shall be in accordance with the manufacturer's recommendations. An open flame shall not come into direct contact with the pavement.

c. Performance Requirements

When the initial average retro-reflectivity measurement is below the required minimum the segment of line shall be removed and replaced with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be removed and replaced with no additional payment.

2. Preformed Plastic and *Extended Warranty Preformed Plastic*

a. Application

~~The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals prior to beginning installation work. No installation work shall begin prior to the Department's receipt of these manuals. These manuals will become the property of the Department.~~

The installation method for Extended Warranty Preformed Plastic markings shall be the overlay method for PCCP and the inlay or overlay method for HMA. The overlay method is defined as placement of preformed plastic markings on the finished pavement surface. The inlay method is defined as placing preformed plastic markings on newly placed HMA immediately prior to the last roller pass. The pavement shall be grooved prior to the placement using the overlay method. This groove shall not exceed 110 mils (3 mm) in depth or one inch (25 mm) wider than the pavement marking to be placed. The equipment used for grooving shall not damage pavement joints.

For non-Extended Warranty Preformed Plastic, the overlay installation method is acceptable for both HMA and PCCP pavements, and no grooving is required.

~~Preformed plastic~~ *The markings* shall be applied when the air temperature is a minimum of 60°F (16°C) and rising, and the pavement temperature is a minimum of 70°F (21°C). ~~Preformed plastic~~ *The markings* shall not be applied if the ambient *air* temperature is expected to drop to below ~~45~~*40*°F (~~7~~*4*°C) within 24 h after application. The pavement surface shall be primed with a binder material in accordance with the manufacturer's recommendations. ~~The pavement surface shall be primed prior to the placement of preformed plastic transverse markings.~~

If there is a dispute regarding installation, the manufacturer shall provide a ~~properly~~ trained representative to ensure that the installation is *properly* performed ~~in accordance with the manufacturer's recommendations~~.

b. ~~Equipment~~ *Performance Requirements*

~~The equipment for applying preformed plastic, furnished in rolls, shall be a portable hand-propelled machine capable of carrying and applying at least two rolls of 4 in. (100 mm) to 16 in. (50 mm) widths. The machine shall be equipped with a guide pointer to keep the machine on an accurate line. The machine shall also be equipped with guide rollers and a pressure roller. The pressure roller may be a separate unit. The machine shall feed the marking material from its original carton through the guide rollers and under the pressure roller onto the pavement. The pressure roller shall be a minimum of 2 in. (50 mm) wider than the width of the marking material and shall weigh a minimum of 200 lb (91 kg). The machine shall also be capable of removing the backing paper from the marking material during the application process. Preformed plastic furnished in strip, symbol, or legend form shall be applied with suitable equipment such as hand rollers.~~

When the initial average retro-reflectivity measurement is below the required minimum the segment of line shall be removed and replaced with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be removed and replaced with no additional payment.

3. ~~Epoxy~~ *Multi-Component*

a. Application

~~Epoxy shall be used on portland cement concrete pavement unless otherwise specified or directed.~~ This material shall be applied only when the pavement *and ambient air* temperature*s* ~~is~~*are* 40°F (5°C) or above. The wet film thickness of the ~~epoxy~~ marking material shall be a minimum of ~~15~~*20* mils (~~380~~*510* µm). Immediately following the application of the ~~epoxy~~ markings, additional reflectorization shall be provided by applying ~~glass~~ beads to the surface of the wet marking at a uniform *minimum* rate of 20 lb/~~100 sq ft~~*gal*(~~9.8~~*2.4* kg/~~10 m~~^{2}*L*) of marking.

b. Equipment

The machine used to apply the ~~epoxy~~ marking material shall precisely meter ~~the two~~ *each* component~~s~~, *and* produce and maintain the necessary mixing head temperature within the required tolerances~~, all in accordance with the manufacturer's recommendations.~~ The machine shall be equipped ~~with a high pressure water blast device ahead of a high pressure air blast device, both as an integral part of the gun carriage, for cleaning the pavement ahead of the marking application~~ *in accordance with 808.07(a)2*. ~~The machine shall also be equipped with the following: a guide pointer to keep the machine on an accurate line; at least two spray guns which can be operated individually or simultaneously; an automatic device which will provide a broken line of the required length; and automatic glass bead dispensers which is synchronized with the marking application.~~

c. Performance Requirements

Pavement marking segments which are found to have an average retro-reflectivity reading below the required minimum shall be re-striped with no additional payment. Pavement markings segments which have more than 5 of 20 individual readings below the minimum required shall be re-striped with no additional payment. The re-striping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments may be re-striped with no additional payment. Following each re-striping, additional retro-reflectivity measurements shall be made with no additional payment. Quality adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-striped markings shall be placed within ±0.25 inches in width and ±2.0 inches in length of the original placed markings. Re-striping will not be permitted more than two times.

808.08 Marking Protection and Maintenance of Traffic

Protection of the traveling public, of the pavement marking crews, and of the pavement markings shall be provided during the marking operation through the use of proper equipment, traffic control devices, safety devices and proper procedures. Traffic control devices shall be placed in accordance with 107.12. Flaggers shall be provided for traffic control as directed.

(a) Vehicle Signs

Each vehicle in the marking operation shall display the slow moving vehicle emblem when operating at speeds of 25 mph (40 km/h) or less. The slow moving emblems shall be removed when the vehicles are operating at speeds greater than 25 mph (40 km/h). The paint crew signs shall be 24 in. (600 mm) high by 96 in. (2400 mm) wide, with 12 in. (300 mm) series C black letters on an orange reflective background. Type A and C flashing arrow signs shall be in accordance with 923.04.

(b) Vehicle Warning Lights

All amber flashing warning lights and amber strobe lights mounted on vehicles used in the marking operation shall be in accordance with 801.14(d). All vehicles used in the marking operation shall have a minimum of one flashing amber warning light or amber strobe light which is visible in all directions.

(c) Cones

Cones shall be used to protect marking material which requires more than 60 s drying time. Cones shall remain in place until the marking material is dry or firm enough not to track or deform under traffic. Cones shall be removed as soon as possible and shall never be left in place overnight. Edge lines shall not require protection with cones.

The maximum spacing of cones shall be as follows:

	40 MPH or less	Over 40 MPH
Broken Lines	every line segment	every 5th line segment
Solid Lines	20 ft to 30 ft (6 m to 9 m)	

(d) Front Escort Vehicles

A front escort vehicle shall be used if the marking vehicle extends across the center line while operating. This front escort vehicle shall be equipped with a forward facing paint crew sign, a rear facing slow moving vehicle emblem, and a red flag mounted at least 10 ft (3 m) above the pavement.

(e) Marking Application Vehicles

Marking application vehicles such as edgeliner or centerliner trucks shall have a rear facing type A or type C flashing arrow sign, an amber flashing warning light mounted near the center of the truck bed and an amber strobe light mounted on each rear corner of the truck bed. The amber flashing warning light and the amber strobe lights shall be mounted on retractable supports and shall be operated at a height of 12 ft (3.7 m) above the pavement unless otherwise directed.

(f) Rear Escort Vehicles

If cones are not required, a rear escort vehicle shall follow a marking application vehicle at a distance of 100 to 500 ft (30 to 150 m). If an additional rear escort vehicle is required due to drying time or heavy traffic volume, it shall follow the first rear escort vehicle at a maximum distance of 1,000 ft (300 m), and may operate in the travel lane or on the paved shoulder.

If cones are required, the cone setting truck shall follow the marking application vehicle and shall be followed by a rear escort vehicle. The cone pick up truck shall be followed by another rear escort vehicle.

All rear escort vehicles shall be equipped with a rear facing type C flashing arrow sign mounted above a rear facing paint crew sign. On two-lane two-way roads, this type C flashing arrow sign shall be operated with the arrowhead turned off. The supply truck may be used as a rear escort vehicle providing it is empty and is equipped with the required traffic control devices.

808.09 Warranty for Durable Pavement Marking Material

Durable pavement marking material shall be warranted against failure resulting from material defects, method of application*, or the result of snowplowing and deicing activities*. The material shall be warranted to retain its color, *retro*-reflectivity, ~~adherence to the pavement~~ *durability* and shall be free of other obvious defects or failures.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

All pavement traffic markings which have failed to meet the warranted conditions shall be replaced with no additional payment.

For the terms of the warranty a unit shall be defined as a 1,000 ft (~~305~~ *300* m) section of line of specified width in any combination or pattern.

The warranty period shall be 180 days beginning with the last working day for the total contract as defined in the final acceptance letter, but not prior to November 1 of the calendar year in which the last pavement markings were installed. If more than 3% of a unit or 3% of the total of any one intersection or set of transverse markings fails, the failed portion shall be replaced. All pavement markings required to be replaced under the terms of this warranty shall be replaced within 60 days of the notification of failure.

808.09.1 Extended Warranty for Preformed Plastic Pavement Marking Material

Extended warranty markings shall be warranted for a period of two years beginning with the last working day for the total contract as defined in the final acceptance letter. The markings will be subject to snowplowing and deicing chemicals. The material shall be warranted to retain its color, retro-reflectivity, and durability and shall be free of other obvious defects or failures.

For the terms of the warranty a unit shall be defined as a 1,000 ft (300 m) section of line of specified width in any combination or pattern.

The retained retro-reflectivity (mcd/m2/lx) as determined by ITM 931 shall meet or exceed the minimum values at all times during the warranty period as follows:

Year	*White*	*Yellow*
1	*400*	*300*
2	*300*	*200*

When a unit of markings is found to have an average retro-reflectivity reading below the required value, the entire unit of markings shall be removed and replaced. If more than 5% of a unit of markings fails due to color or durability, the entire unit shall be removed and replaced.

All pavement markings required to be replaced under the terms of this warranty shall be replaced within 60 days of the notification of failure.

808.10 Removal of Pavement Markings

Pavement markings which conflict with revised traffic patterns and may confuse motorists shall be removed immediately before, or immediately following, any change in traffic patterns as directed or approved.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

Removal of pavement markings shall be to the fullest extent possible without materially damaging the pavement surface. Pavement marking removal methods shall be sandblasting, steel shot blasting, waterblasting, grinding or other approved mechanical means. Grooving will not be permitted. Grinding will only be permitted under the following conditions:

(a) when removing durable pavement markings, or

(b) when removing non-durable markings where another course of material is to be placed on the existing course.

Painting over existing pavement markings to obliterate them will not be permitted.

When a blast method is used to remove pavement markings, the residue, including sand, dust and marking material, shall be vacuumed concurrently with the blasting operation or removed by other approved methods. Accumulation of sand, dust or other residual material, which might interfere with drainage or constitute a traffic hazard, will not be permitted.

All damage to the pavement caused by pavement marking removal shall be repaired by approved methods with no additional payment.

808.11 Snowplowable Raised Pavement Markers

Snowplowable raised pavement markers shall be used as supplemental delineation at the locations shown on the plans or as directed.

(a) Surface Preparation

The pavement or bridge deck surface shall be cleaned of dirt, dust, oil, grease, moisture, curing compound, and loose or unsound layers of all materials which would interfere with the proper bonding of the marker to the pavement or bridge deck.

(b) Location

Marker locations shall be accurately laid out and approved prior to the installation operation. Markers shall not be located on surfaces that show visible evidence of cracking, checking, spalling or failure of underlying materials. Markers shall not be located within the intersection of a public road. Any marker location, which falls on any of the restricted areas, shall be moved a longitudinal distance not to exceed 10% of the required marker spacing. If this adjusted location still falls within a restricted area, then that marker location shall be deleted. Marker locations shall be as shown on the plans.

(c) Reflector Color

The color combinations of the reflectors shall be as shown on the plans unless otherwise directed. When replacement prismatic reflectors are specified, such reflectors shall not be ordered until the quantity and color combinations have been determined and approved.

(d) Installation

Marker installation shall be in accordance with the manufacturer's recommendations. The pavement surface temperature and the ambient *air* temperature shall be at least 50°F (10°C). The pavement surface shall be dry at the time of marker installation. The installation slot shall be clean and dry before the adhesive is applied. The slot shall be filled with sufficient adhesive to provide a water tight seal between the marker base and the pavement, and to fill all voids between the marker base and the surfaces of the slot. The marker shall be placed in the slot so that the tips of the snowplow deflecting surfaces are below the pavement surface.

If the pavement surface is newly placed HMA, the pavement shall be allowed to cure for two days prior to installing the markers.

Installation of markers on new concrete pavement or bridge decks or on newly overlaid bridge decks shall not be done until after the pavement or bridge deck is ready to be opened to traffic as specified elsewhere herein.

The number of slots cut in one day shall not exceed the number of markers which will be installed in that day. No slots shall be left open overnight.

(e) Removal of Markers

Markers designated for removal shall be as located on the plans or as otherwise specified or directed. If the pavement surface or bridge deck surface is to be removed, the markers shall be removed prior to any surface removal operation.

The markers shall be removed with a jack hammer or other approved equipment. ~~Care shall be taken so as not to damage the marker base during its removal~~. The area of the pavement or bridge deck disturbed by the marker removal shall not exceed 3 in. (75 mm) in depth nor 3 in. (75 mm) out from all sides of the marker base. The marker removal operation shall stop if it is determined that excessive damage is occurring to the pavement, *or* bridge deck ~~or marker base~~.

The resulting holes shall be filled with the appropriate patching material as described herein or as otherwise directed. Concrete pavement which is to be overlaid as part of the contract and HMA pavement shall be patched with HMA intermediate materials. Concrete pavement which is not to be overlaid as part of the contract and concrete bridge decks shall be patched with magnesium phosphate concrete patching material. Overlaid bridge decks and bridge decks which are to be overlaid as part of the contract shall be patched with patching material which is compatible with the deck overlay material. All patching material shall be placed in accordance with the appropriate specifications for the patching material.

Removed markers shall ~~remain~~ *become* the property of the ~~Department unless otherwise specified~~ *Contractor and removed from the jobsite prior to the completion of the work*.

~~Removed snowplowable raised pavement markers shall be delivered to the District Traffic Division. The markers shall be delivered in 55 gal. (210 L) metal containers with lids which may be sealed. The metal containers shall be furnished either by the Contractor or by the District Traffic Division as specified in the contract. Approximately 50 markers shall be placed in each container. Each container shall be labeled as to how many markers it contains.~~

~~All metal containers used for delivering removed markers will remain the property of the Department when no longer required for the contract.~~

(f) Replacement of Prismatic Reflectors

Reflectors designated for replacement shall be as shown on the plans or as otherwise directed. Prior to placement of the new reflector, the castings shall be cleaned of all remaining butyl pad materials. All loose or foreign material shall be satisfactorily removed by sandblasting, wire brush, or other approved mechanical means. Removed reflectors shall be disposed of properly off the project site.

808.12 Method of Measurement

Broken lines, placed or removed, will be measured as 1/4 of the total distance in linear feet (meters) of the broken line pattern after excluding gaps for intersections or other openings. Solid lines will be measured as the total distance in linear feet (meters) of solid lines placed or removed. The material, type, color, or width of broken or solid lines to be removed will not be considered when measuring such lines for payment.

Transverse marking lines will be measured as the total distance in linear feet (meters) of lines placed or removed. Curb markings will be measured by the linear feet (meters) along the front face of the curb. ~~The "No Parking Any Time" sign will be measured in accordance with 802.11~~*Center curb painting will be measured by the area of the top of the curb not included in the measurement of the other curb markings*. Pavement message markings will be measured by the total number of each type placed. A railroad crossing pavement message marking shall include the two R's, the X, and the three stop lines per traffic lane. Railroad crossing pavement message markings will be measured by the total number of each marking place. Lane indication arrow pavement message markings will be measured by the number of lane indication arrowheads placed. Removal of pavement message markings will be measured in square yards (square meters) using areas shown in the following table. The material will not be considered when measuring such markings for pavement.

Pavement Message Markings Table

Description	**Area**
"Ahead"	3.1 SYS (2.6 m2)
Combo Arrow	3.1 SYS (2.6 m2)
"Exit"	2.5 SYS (2.1 m2)
"Left"	2.5 SYS (2.1 m2)
"Only"	2.5 SYS (2.1 m2)
Railroad "R"	0.6 SYS (0.5 m2)
"Right"	3.2 SYS (2.7 m2)
"RXR"	7.7 SYS (6.4 m2)
"School"	3.9 SYS (3.3 m2)
"Stop"	2.6 SYS (2.2 m2)
Straight Arrow	1.4 SYS (1.2 m2)
"Turn"	2.6 SYS (2.2 m2)
Turn Arrow	1.7 SYS (1.4 m2)
"XING"	2.5 SYS (2.1 m2)

Snowplowable raised pavement markers will be measured by the number placed or removed. Prismatic reflectors will be measured by the number furnished and installed. Each 2-way prismatic reflector will be measured as one reflector. No measurement will be made of the adhesive or the hole patching material used in the placement or removal of snowplowable raised pavement markers.

808.13 Basis of Payment

Lines and transverse markings placed will be paid for at the contract unit price per linear foot (meter) for the material, type, color, and width specified. Curb markings will be paid for at the contract unit price per linear foot (meter) for curb painting, of the color specified. ~~The "No Parking Any Time" sign will be paid for in accordance with 808.13.~~ *Center curb painting will be paid for at the contract unit price per area of the top of the curb not included in the payment of other curb markings.* Pavement message markings placed will be paid for at the contract unit price per each, for the material and message specified. Lines and transverse markings removed will be paid for at the contract unit price per linear foot (meter). Pavement message markings removed will be paid for at the contract unit price per square yard (square meter).

Snowplowable raised pavement markers, furnished and installed, or removed will be paid for at the contract unit price per each. Prismatic reflectors will be paid for at the contract unit price per each. ~~e~~*E*ach 2-way prismatic reflector will be paid for as one reflector.

Payment for furnishing, calibrating, and operating retro-reflectivity testing equipment will be paid for at the contract price for lump sum. The cost of report

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

preparation shall be included in the cost of retro-reflectivity testing. Adjustments to the contract payment with respect to retro-reflectivity of performance based pavement markings will be included in a quality adjustment in accordance with 109.05.1. The Engineer may waive retro-reflectivity testing due to weather limitations. If retro-reflectivity testing is waived, no payment will be made for retro-reflectivity testing and no quality adjustment for retro-reflectivity will be made. If retro-reflectivity testing is not performed and is not waived by the engineer due to weather, no payment will be made for retro-reflectivity testing and payment for the marking items will be made at the 70% required minimum level.

~~If no pay items are shown in the Schedule of Pay Items for the required permanent pavement markings, a change order will be executed.~~

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Center Curb Painting	*SFT(m2)*
Curb Painting, _____ (color)	LFT (m)
Line, _____, _____, _____, _____ in. (mm) (material, type, color, width)	LFT (m)
Line, Remove	LFT (m)
Pavement Message Marking, _____, _____ (material, message)	EACH
Pavement Message Marking, Remove	SYS (m2)
Prismatic Reflector	EACH
Retro-Reflectivity Testing	*LS*
Snowplowable Raised Pavement Marker	EACH
Snowplowable Raised Pavement Marker, Remove	EACH
Transverse Marking, _____, ~~_____~~, _____, _____ in. (mm) (material, ~~type~~, color, width)	LFT (m)
Transverse Marking, Remove	LFT (m)

~~No additional payment will be made for the second application of traffic paint and glass beads as required in 808.07(a)1.~~

No additional payment will be made for the replacement of markings that fail to meet the warranty conditions of 808.09.

~~The cost of metal containers for disposal of removed snowplowable raised pavement markers, if furnished by the Contractor, shall be included in the cost of other pay items. The cost of picking up and returning such metal containers, if furnished by the District Traffic Division, shall be included in the cost of other pay items.~~

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

~~The cost of delivering removed and packaged snowplowable raised pavement markers to the designated location shall be included in the cost of transportation of salvageable materials.~~

The cost of removal of existing prismatic reflectors shall be included in the cost of prismatic reflectors.

~~Glass~~ ~~b~~*B*eads, binder material for thermoplastic and preformed plastic, adhesive for snowplowable markers, patching material for snowplowable marker removal, pavement cleaning *and surface preparation*, ~~removal of excess or loose existing pavement marking material, where new pavement markings are being placed in the same location,~~ and all necessary incidentals shall be included in the cost of the pay items.

The cost of grooving prior to placing extended warranty preformed plastic shall be included in the cost of the pay item.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT

909.05 ~~White and Yellow Traffic Paint~~ *Blank*

~~(a) Blank~~

~~(b) Fast Dry Traffic Paint~~

~~1. General Requirements~~

~~The general requirements specified in 909.01 shall apply except as modified herein.~~

~~White and yellow traffic paint shall be used on pavements for centerlines, lane lines, or as otherwise specified. In addition to its other requirements, when glass beads are applied, it shall be such that it shows capillary action in the interstices and voids existing between the beads sufficient to cause the level of the paint to be raised approximately 2/3 the diameter of the beads to provide anchorage and refraction. The capillary action shall be such that it does not cause complete envelopment. The paint, as furnished, shall contain no glass beads.~~

~~The paint shall be ground to a uniform consistency, and it shall permit satisfactory application by the pressure spray type of painting machine. This painting equipment is designed to apply reflectorized lines, using a pressurized bead application method, 4 to 6 in. (100 to 150 mm) wide, at a wet film thickness of 0.015 in. (380 µm) on clean dry pavement, with the material being heated at a maintained temperature from ambient air temperature to a maximum of 180°F (82°C), at the atomized spray gun, at a minimum ambient temperature of 40°F (4°C). The material shall be capable of being applied under these conditions at speeds of 10 to 15 mph (16 to 24 km/h). The material shall have physical characteristics which permit it to be pumped at a minimum temperature of 40°F (4°C) through pumps from the shipping container into the paint tank on the paint machine, and then by pumps through the paint machine plumbing system to and through the heat exchanger and to the spray gun at the proper pressure and temperature.~~

~~2. Specific Requirements~~

~~The paint shall dry to a no tracking condition in no more than 60 s. The no tracking condition shall be determined by actual application on the pavement at a wet film thickness of 15 mils (380 µm) with white or yellow paint covered with glass beads at a rate of 6 lb/gal. (0.7 kg/L). The paint lines for this test shall be applied with the specialized striping equipment operated so as to have the paint at temperatures up to 180°F (82°C) at the spray orifice. This maximum no tracking time shall not be exceeded when the pavement temperature varies from 35 to 120°F (2 to 49°C), and under all humidity conditions providing that the pavement is dry. The no tracking time shall be determined by passing over the paint line 60 s after paint application, in a simulated passing maneuver at a constant speed of 30 to 40 mph (48 to 64 km/h) with a passenger car. A line showing no visual deposition of the paint to the pavement surface when viewed from a distance of approximately 50 ft (15 m) from the point where the test vehicle has crossed the line shall be considered as showing no tracking and conforming to~~

the requirement for field drying conditions. This field dry time test shall be used for production samples only.

In addition to the above, the paint shall meet the following requirements.

	Min.	Max.
Pigment, Federal Standard 141A, Method 4022, percent by weight (mass)	54	60
Titanium Dioxide, ASTM D 476, Types II, III, and IV, white only, lb/gal. (g/L) of paint	0.8 (96)	-
Medium Chrome Yellow, ASTM D 211, Type III, yellow only, lb/gal. (g/L) of paint	1.2 (144)	–
Other pigments may be used, provided the amount of pigment is such that there will be a minimum of 1.04 lb/gal. (0.125 kg/L) of pure lead chromate per gallon of paint.		
Vehicle Solids, percent of vehicle by weight (mass), Federal Standard 141A, Method 4053	35	–
Total Non-Volatiles, Federal Standard 141A, Method 4042, percent by weight (mass)	72	–
Viscosity @ 77°F (25°C), ASTM D 562, Krebs Units	80	100
C.I.E. illuminant C, 2° standard observer, ASTM E 1349, percent		
White	84	–
Yellow	50	–
Color, yellow only, x-y C.I.E. coordinates for green limit, FHWA color chart of June 1965 C.I.E. illuminant C, 2° standard observer	Match the green limit ± 8%	
Contrast ratio, ASTM D 2805, wet film 15 ± 1 mil (380 ± 25 µm) black - white chart paper, air dried at least 16 h	0.96	–
Uncombined (free) Water, Federal Standard 141A, Method 4081, percent	–	1.0

(c) White and Yellow Waterborne Traffic Paint

White and yellow waterborne traffic paints shall consist of an emulsion of pigmented binder.

When glass beads are induced into the paint lines, the paint shall provide capillary action in the interstices and voids between the glass beads sufficient to cause the level of paint to raise approximately 2/3 the diameter of the glass beads. This capillary action shall not cause complete envelopment of the glass beads. The paint as furnished shall not contain glass beads. The paint shall be ground to a uniform consistency, and it shall permit satisfactory application by the pressure-spray type of painting equipment. The painting equipment shall use a pressurized bead application method that is designed to apply 4 to 6 in. (100 to 150 mm) reflectorized paint lines at paint temperature up to 150°F

~~(65°C). The paint shall be capable of being applied at speeds of 10 to 15 mph (15~~ to 25 ~~km/h).~~

~~The paint shall not darken under the heating conditions of application, or show appreciable discoloration due to sunlight exposure and aging of the paint lines. The paint shall be furnished ready for use without thinning, screening, or other modifications and shall not settle, cake, curdle, liver, gel, or have an excessive change in viscosity in the container during a period of one year after manufacture. The paint shall be capable of being stirred to a uniform consistency. The paint shall be able to withstand variations of temperatures when stored outside in the containers as delivered, and in an environment above 40°F (5°C). All paint furnished under these specifications will be rejected if it contains skins, thickened or jelly-like layers, lumps, coarse particles, dirt, or other foreign materials which prevent the proper application of the paint, or produces a non-uniform paint line. All paint which cannot be transferred by pumps on the paint equipment from the shipping containers and through the paint equipment due to excessive clogging of screens, filters, or paint guns will be rejected.~~

~~The paint shall dry to a no-tracking condition in less than 60 s. The no tracking condition shall be determined by actual application of the paint on the pavement at a wet film thickness of 15 mils (380 µm) with glass beads at a rate of 6 lb/gal. (0.7 kg/L). The paint lines for the determination of no-tracking condition shall be applied with the specialized painting equipment operated so as to have the paint at application temperatures up to 140°F (60°C) at the spray guns. This maximum no tracking time shall not be exceeded when the pavement temperature varies from 50 to 120°F (10 to 50°C), and with all relative humidity conditions providing that the pavement is dry. The no tracking time shall be determined by passing over the paint line 60 s after the paint application, in a simulated passing maneuver at a constant speed of 30 to 40 mph (50 to 65 km/h) with a passenger car. A paint line with no visual deposition of the paint to the pavement surface when viewed from a distance of approximately 50 ft (15 m) from the point where the vehicle crossed the paint line shall be considered as showing a condition of no tracking and being in accordance with the requirement.~~

~~1. Composition Requirements~~

~~The exact composition of the waterborne traffic paint shall be left to the discretion of the manufacturer, provided that the finished product is in accordance with all of the specification requirements.~~

~~The pigment portion of these paints shall be a combination of prime and extender pigments as required to produce either white or yellow waterborne traffic paint in accordance with the color and other requirements of the finished product. The yellow waterborne traffic paint pigment shall contain pigment yellow Colour Index Number 65 and/or 74 and/or 75. The white waterborne traffic paint pigment shall contain titanium dioxide in accordance with ASTM D 476. The non-volatile portion of the vehicle shall be composed of a 100% acrylic polymer.~~

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT (CONTINUED)

The cured film of waterborne traffic paint shall not contain toxic heavy metals above the limits of the regulatory levels of 40 CFR 261.24 Table 1 when tested in accordance with EPA Toxicity Characteristics Leaching Procedure Test Method 1311 in Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, EPA publication SW-846. It shall not contain other hazardous materials which would require characterization as a hazardous waste for the disposal of the dried film.

2. Specific Requirements

	Minimum	**Maximum**
Volume solids, ASTM D 2697, %	58.0	--
Total solids by mass, ASTM D 3723, %	73.0	--
Pigment by mass, ASTM D 3723, %	45.0	57.0
Vehicle solids by mass of the vehicle, %	44.0	--
Viscosity, ASTM D 562, Kreb Units	75	95
Unit mass @ 77°F (25°C), ASTM D 1475, lb/gal. (kg/L)	12.50 (1.498)	--
Unit mass @ 77°F (25°C), variation between manufacturer's production batches, ASTM D 1475, lb/gal. (g/L)	--	0.20 (24)
Dry time, ASTM D 711, 15 mils (380 µm) wet film thickness, at 77°F (25°C), 50% ± 5% relative humidity, airflow of less than 50 ft3/min (1.4 m3/min), without glass beads	--	10 min
Reflectance Factor, Y, C.I.E. illuminant, C, 2° standard observer, ASTM E 1349, 15 mils (380 µm) wet film thickness, air dried a minimum of 16 h, %		
White	84	--
Yellow	50	57
Color, yellow only, x & y C.I.E. Coordinates for the strong limits of FHWA color chart	Match the strong	± 6.00

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT (CONTINUED)

~~PR1, 15 mils (380 µm) wet film thickness, air dried a minimum of 16 h, measured on white background, C.I.E. illuminant, C, 2° standard observer, % deviation~~	~~limits~~	
~~Coarse material retained on a No. 30 (600 µm) sieve, ASTM D 185, %~~	~~--~~	~~0.05~~
~~Bleeding ratio, Federal Specifications TT-P-1952B, except asphalt saturated felt paper shall be in accordance with ASTM D 226, Type I~~	~~0.97~~	~~--~~
~~Contrast ratio, ASTM D 2805, 10 mils (254 µm) wet film thickness on Leneta Form 2A or 2C, air dried a minimum of 16 h~~	~~0.96~~	~~--~~
~~Volatile organic compounds, ASTM D 3960, lb/gal. (g/L)~~	~~--~~	~~1.25 (150)~~
~~Abrasion resistance, Federal Specifications TT-P-1952B, L~~	~~190~~	~~--~~
~~Freeze-thaw stability, Federal Specifications TT-P-1952B, change in consistency, Kreb Units~~	~~--~~	~~10~~
~~Heat stability, Federal Specifications TT-P-1952B, change in consistency, Kreb Units~~	~~--~~	~~10~~
~~Scrub resistance, ASTM D 2486, with abrasive medium and shims, cycles~~	~~300~~	~~--~~
~~Water resistance, Federal Specification TT-P-1952B~~	~~Film shall not soften, blister, wrinkle, or lose adhesion~~	
~~Flexibility, Federal Specifications TT-P-1952B~~	~~No cracking or flaking of film~~	
~~Infrared spectrum of the vehicle ASTM D 3168~~	~~Shall match spectrum of manufacturer's~~	

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT (CONTINUED)

~~previously submitted samples~~

~~Dilution test shall be capable of dilution with water at all levels without curdling or precipitation such that wet paint can be cleaned up with water only.~~

~~3. Formulation Approval~~

~~The manufacturer shall obtain approval of the waterborne traffic paint formulation prior to furnishing the paints. Only waterborne traffic paints from the Department's list of approved Coating Formulations shall be used. Waterborne traffic paint formulations will be placed and maintained on the Department's list of approved Coating Formulations in accordance with ITM 606.~~

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS

SECTION 921 – PAVEMENT MARKING MATERIALS

921.01 ~~Traffic Paint~~ *Blank*

~~Traffic paint shall be in accordance with 909.05~~.

921.02 Durable Marking Material

Durable marking material shall be thermoplastic, preformed plastic, or ~~100% solids epoxy~~ *multi-component pavement markings. The materials shall not contain any toxic heavy metals above the limits of the regulatory levels of 40 CFR 261.24, table 1, when tested in accordance with EPA TCLP, or contain any other material which will require characterization as a hazardous waste when removed from the pavement surface.*

(a) Thermoplastic

This material shall be in accordance with AASHTO M 249 *and shall not contain lead chromate pigments*.

Heat bonded preformed thermoplastic shall be in accordance with AASHTO M 249 with the exception of the relevant differences due to the material being supplied in preformed state. The application properties as outlined in section 5 of AASTHO M 249 shall not apply. Drying time and short term and long term flowability requirements are not applicable at time of installation. The material shall be capable of fusing to itself and previously applied thermoplastic pavement markings when heated. The material shall contain a minimum of 30% beads by weight. The beads must be homogeneously blended throughout the material. The marking thickness throughout its width, before the material is heated up, shall be supplied at a minimum average thickness of 90 mils (2.3 mm).

(b) Preformed Plastic *and Extended Warranty Preformed Plastic*

This material shall consist of a homogeneous preformed plastic film with ~~a minimum thickness of 60 mils (1.5 mm) and~~ a width as specified. ~~The preformed plastic material shall have a precoated adhesive and an easily removable backing which shall protect the adhesive in storage and facilitate rapid application. The adhesive shall allow the preformed plastic material to be repositioned on the pavement surface to which it is applied before permanently fixing it in its final position with downward pressure.~~ *Dimensional requirements shall meet one of the following:*

1. *Preformed plastic material shall have a smooth plane surface, with a minimum thickness of 60 mils (1.5 mm) throughout the entire cross section, or*

2. *Preformed plastic material shall have an embossed patterned surface with 35% to 65% of the surface area raised. The edges of the raised areas shall present a near vertical face to traffic from any direction. The minimum thickness of the raised area shall be 60 mils (1.5 mm). The area between the raised areas shall be a minimum of 20 mils (0.5 mm) measured at the thinnest section of the cross section.*

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

The material shall have a precoated adhesive ~~and an easily removable backing which shall protect the adhesive in storage and facilitate rapid application~~. The adhesive shall allow the preformed plastic material to be repositioned on the pavement surface to which it is applied before permanently fixing it in its final position with downward pressure.

The ~~plastic~~ material shall be capable of being affixed to either HMA or PCCP by means of the precoated adhesive and, following the initial application of pressure, shall mold itself to pavement contours, breaks, and faults by traffic action at normal pavement temperatures.

The near vertical faces of patterned preformed plastic shall be coated with a layer of beads.

A type C certification in accordance with 916 shall be furnished for the marking materials except materials used for temporary pavement markings.

~~The color of the white plastic film shall be determined by a standard color difference meter, such as the Gardner Color Difference Meter manufactured by Gardner Laboratories, Inc. Bethesda, Maryland. The plastic film shall not show deviations from a magnesium oxide standard greater than the following.~~

~~SCALES~~	~~DEFINITION~~	~~MAGNESIUM OXIDE~~	~~SAMPLE~~
~~Rd~~	~~Reflectance~~	~~100~~	~~70 Minimum~~
~~a~~	~~Redness-Greenness~~	~~0~~	~~-5 to +5~~
~~b~~	~~Yellowness-Blueness~~	~~0~~	~~-10 to +10~~

~~The color of the yellow plastic film shall visually match color No. 33538 of Federal Standard 595a. The pigment shall include medium chrome yellow.~~

~~1. Material Requirements~~

~~The material shall be composed of plasticizers, pigments, and glass beads. The pigment shall contain 20% minimum titanium dioxide for white plastic material. During manufacture, glass beads shall be mixed into the compound at a minimum of 15% and a maximum of 20% by weight. A layer of glass beads shall be bonded to the top surface.~~

~~a. Tensile Strength~~

~~The specimens for this test shall be type I prepared in accordance with ASTM D 638 (D 638M). A sample 6 in. by 1 in. (150 mm by 25 mm) shall be tested at a temperature between 70°F (21°C) and 80°F (27°C) using a jaw speed of 0.25 in. (6.4 mm) per minute. 1 in. (25 mm) squares of carborundum extra coarse emery cloth or equivalent may be applied to each end of the test sample to prevent the plastic adhesive from adhering to the test equipment. The break resistance shall be based on an average of at least three samples. The elongation of the film at rupture shall be 15% minimum and 50% maximum. The minimum tensile strength shall be 40 psi (275.8 MPa).~~

~~**b. Adhesive Stability Test**~~

~~A 3 in. by 6 in. (75 mm by 150 mm) sample of plastic material shall be applied to a 3 in. by 6 in. (75 mm by 150 mm) piece of carborundum extra coarse emery cloth or equivalent, so that a 3 in. by 3 in. (75 mm by 75 mm) overlap occurs. The specimen shall withstand a static load of 4 lb (17.8 N) for a period of 30 min, in accordance with ASTM D 816, method B. The slippage between the plastic sample and the emery cloth shall not exceed 1 in. (25 mm). The test shall be conducted at a temperature between 70°F (21°C) and 80°F (27°C).~~

~~**c. Adhesive Shear Strength**~~

~~Specimens shall be tested in accordance with the method described in ASTM D 638 (D 638M) as modified to test the adhesive shear strength. Plastic samples cut to dimensions of 1 in. by 6 in. (25 mm by 150 mm) shall have applied to the adhesive face a 1 in. by 3 in. (25 mm by 75 mm) piece of carborundum extra coarse emery cloth, or its equivalent, so that there is a 1 in.^{2} (645 mm^2) overlap at one end of the plastic specimens. A pressure of 50 psi (344.7 kPa) shall be applied over this area for a period of 30 s. The load shall be applied by gripping each end of the test piece in a suitable tensile test machine such as a Dillon or Scott Tester. The average of the load required to break the adhesive bond shall be 10 lb (4.5 kg) minimum. The speed of testing shall be conducted at a temperature between 70°F (21°C) and 80°F (27°C) and at a speed of 2 in. (50 mm) per minute.~~

~~**d. Bend Test**~~

~~At a temperature of 80°F (27°C) the property of the plastic material shall be such that a piece 3 in. by 6 in. (75 mm by 150 mm) with the side covered by backing paper placed against a 1 in. (25 mm) mandrel may be bent over the mandrel until the end faces are parallel and 1 in. (25 mm) apart. Visual inspection shall show no apparent fracture lines in the uppermost surface.~~

~~2~~*1*. Packaging

Each package shall be marked to indicate the color of the material, specific symbol or word message, the batch number, the manufacturer's name, address, and the date of manufacture.

~~3~~*2*. Basis For Use

A type C certification in accordance with 916 shall be furnished for the preformed plastic material except materials used for temporary pavement markings.

(c) ~~100% Solids~~ ~~Epoxy~~ *Multi-Component*

~~This material shall be a two component material. Component A shall consist of pigment and epoxy resins formulated as set out by the manufacturer. The mixing ratio for the two components of the material shall be as recommended by the material manufacturer. This ratio shall not vary more than ± 2 1/2% during the mixing operation or the application procedures of these materials.~~

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

The material shall be for use on both HMA and PCC pavements. The material shall consist of a pigmented resin system of epoxy. The multi-component pavement markings shall be ultra-violet light resistant and shall not darken during the heating conditions of application, chalk, crack, show appreciable degradation or discoloration due to sunlight exposure and aging of the markings. The cured multi-component pavement markings shall be impervious to salts, grease, oil, fuels, acids, alkalies and other common chemicals that may be found in or on HMA and PCC pavements. The pigment in the white material shall contain titanium dioxide in accordance with ASTM D 476.

The material shall be provided in containers, which are in accordance with current Federal DOT regulations. Each container shall be labeled in accordance with 29 CFR 1910.1200 and include the trade name or trade mark, formulation or product identification, date of manufacturer, color, batch or lot number, component identification and mixing instructions.

~~Component A shall have the following properties.~~

~~Property~~	~~Minimum % by Weight~~
~~Pigment~~	
~~White, TiO_2, conforming to ASTM D 476, Type II~~	~~22~~
~~Yellow, Medium chrome yellow conforming to ASTM D 211, Type III~~	~~25~~
~~Epoxy Resins~~	
~~White~~	~~77~~
~~Yellow~~	~~70~~

~~The pigment composition shall consist of either titanium dioxide or medium chrome yellow. The epoxide value shall be tested in accordance with ASTM D 1652 and shall be 300 to 375 for both white and yellow component A, pigment free basis.~~

~~Component B shall be a curing agent and shall have the amine number tested in accordance with ASTM D 2071. The amine number shall be 300 to 450.~~

~~The system, component A plus component B, shall contain no volatile solvents.~~

~~**1. Material Requirements**~~

~~**a. Glass Beads**~~

~~The glass beads shall be in accordance with 921.02(e).~~

~~**b. Abrasion Resistance**~~

~~The material shall be abraded with 1000 cycles using a 1000 gram load on CS-17 wheels in accordance with ASTM D 4060. The average loss in weight shall not exceed 82 milligrams. The tests shall be run on cured samples which have been applied at a film thickness of 15 mils ± 1 1/2 mils (375 µm ± 38 µm) to code S-16 stainless steel plates.~~

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~The films shall be allowed to cure at a temperature between 70°F (21°C) and 80°F (27°C) for 72 h prior to performing the indicated test. The test panel shall be unbeaded.~~

~~c. Hardness~~

~~The epoxy materials shall be tested in accordance with ASTM D 2240 and have a Shore D hardness of between 75 to 100. Films shall be cast on a suitable substrate at 15 mils ± 1 1/2 mils (375 µm ± 38 µm) in thickness and allowed to cure at a temperature between 70°F (21°C) and 80°F (27°C) for 72 h prior to performing the indicated test.~~

~~d. Tensile Strength~~

~~The material shall be tested in accordance with ASTM D 638 (D 638M). The tensile strength shall not be less than 6000 psi (41.4 MPa). The type IV specimens shall be cast in a suitable mold not more than 1/4 in. (6.4 mm) thick. The samples shall be allowed to cure at a temperature between 70°F (21°C) and 80°F (27°C) for 72 h prior to performing the indicated tests. The rate of pull shall be 1/4 in. (6.4 mm) per minute.~~

~~e. Compressive Strength~~

~~The material shall be tested in accordance with ASTM D 695 (D 695M), except as modified herein. The cured epoxy material shall have a minimum compressive strength of 12,000 psi (82.7 MPa). The cast sample shall be conditioned at a temperature between 70°F (21°C) and 80°F (27°C) for 72 h before performing the indicated tests. The maximum rate of compression of these samples shall be 1/4 in. (6.4 mm) per minute. The sample size shall be 1/2 in. (13 mm) high by 1/2 in. (13 mm) in diameter.~~

~~f. Weather Resistance~~

~~The mixed epoxy compound, both white and yellow, shall be applied to 3 in. by 6 in. (75 mm by 150 mm) aluminum panels at a thickness of 15 mils ± 1 mil (375 µm ± 25 µm) with no glass beads and cured at a temperature between 70°F (21°C) and 80°F (27°C) for 72 h. The cured samples shall be exposed in an Environment Testing Chamber as described in ASTM G 154. The test shall be conducted for 80 h at 122°F (50°C) in alternating cycles of 4 h condensation and 4 h ultraviolet light.~~

~~SPECIMEN~~	~~REQUIREMENTS~~
~~White Material~~	~~ASTM E 1347, directional reflectance a minimum 80% after exposure.~~
~~Yellow Material~~	~~Initially conform to V+ to C+ limits when visually compared with the highway yellow color tolerance chart, PR#1 of June 1965. The color of exposed material shall be within V+, C+, and H+ limits when visually compared.~~

~~g. Laboratory Drying Time~~

~~The epoxy pavement marking material shall be mixed in the proper ratio and applied at 15 mils ± 1 1/2 mil (375 µm ± 38 µm) wet film thickness at 75°F ± 2°F (24°C ± 1°C) with the proper application of glass beads. It shall exhibit a maximum no tracking time of 10 min when tested in accordance with ASTM D 711.~~

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~**h. Viscosity**~~

~~Formulations of each component shall be such that the viscosity of both components shall coincide within 10% at a recommended spray temperature. Component B shall be formulated so as to have a steady and constant viscosity at temperatures recommended for spray application.~~

~~**2. Materials Preparation**~~

~~Before mixing, the individual components shall be heated to the following temperatures.~~

~~Component~~	~~Temperature °F (°C)~~
~~A~~	~~90 to 100 (32 to 38)~~
~~B~~	~~70 to 100 (21 to 38)~~

~~Each component shall be stirred thoroughly prior to mixing. After mixing, the application temperature for the combined materials at the gun tip shall be between 90°F (32°C) and 100°F (38°C).~~

~~**3. Packaging and Storage**~~

~~The epoxy material shall be shipped to the job site in white epoxy lined drums which are plainly marked with the manufacturer's name and address, component identification A or B, the color of the material, date of manufacture, and batch number. Storage shall be at temperatures between 35°F (2°C) and 100°F (38°C).~~

~~The reflective glass beads shall be shipped in 50 lb (22.7 kg) moisture resistant bags. Each bag shall be marked in accordance with 921.02(e).~~

~~**4. Basis For Use**~~

Multi-component ~~P~~*p*avement marking material~~, except glass beads and material used for temporary pavement markings,~~ furnished under this specification shall be covered by a type ~~A~~ *C* certification in accordance with 916. ~~A type A certification shall be furnished for each batch supplied. The material manufacturer shall perform all tests included elsewhere herein on each batch and shall provide these test results as part of the type A certification.~~

~~**(d) Raised Pavement Marker**~~

~~The raised pavement marker shall be either snowplowable, which is inset into the pavement, or temporary, which is affixed with adhesive to the pavement surface.~~

~~**1.**~~ ***(d)*** **Snowplowable Raised Pavement Marker *and Cast Metal Base***

Snowplowable raised pavement marker shall consist of a ~~durable~~ *cast metal* base to which is attached a replaceable prismatic ~~retro-~~reflector for reflecting light longitudinally along the pavement from a single or from opposite directions. Both ends of the casting shall be shaped to deflect a snowplow blade upward.

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

The prismatic reflectors and cast metal bases shall be in accordance with ASTM D 4383. Only prismatic reflectors and cast metal bases from the Department's list of approved snowplowable pavement markers shall be used.

~~a. Prismatic Reflector~~

~~The dimensions of the reflector face shall be nominal width of 4 in. (100 mm) and a minimum vertical height of 0.460 in. (12 mm) with a slope of 30 degrees from the horizontal to the face. Minimum reflecting surface area shall be 1.62 in.^{2} (1045 mm^2). The reflectors shall consist of an acrylic plastic shell filled with tightly adherent potting compound. The shell shall contain one of two prismatic faces. The reflector shall be in the shape of a shallow frustrum of a pyramid. The bottom of the reflector shall be equipped with a pressure sensitive adhesive for attachment. The shell shall be molded of methyl methacrylate conforming to Federal Specification L-P-380c, Type 1, Class 3. The filler shall be potting compound selected for strength, resilience and adhesion adequate to pass the necessary physical requirements. The adhesive shall be pressure sensitive, 100% solids, 0.040 in. (1.0 mm) thick with closed cell release paper on the bottom. Pressure sensitive adhesive shall meet the requirements of adhesive tensile strength test.~~

~~Prismatic reflectors shall not be installed on bases until the adhesive in the pavement slots has properly hardened. All rust or foreign matter shall be removed from the surface of the base and the base shall be coated with a primer in accordance with the manufacturer's recommendations. The release paper shall be peeled from the butyl adhesive bottom of the reflector. The reflector shall be inserted into the recessed attachment area and a downward pressure of 150 lb (667 N) shall be applied for 3 s.~~

~~(1) Optical Performance~~

~~In order to perform the optical performance test, the following definitions shall apply. Horizontal incident angle shall mean the angle in the horizontal plane between the direction of incident light and the normal to the leading edge of the reflector. Reflective intensity shall mean candlepower of the return light at the chosen divergence angle for each 10.76 footcandle (lux) of illumination at the reflector on a plane perpendicular to the incident light.~~

~~A steel wool abrasion test shall be performed by forming a 1 in. (25 mm) diameter flat pad using No. 3 coarse steel wool. The steel wool pad shall be placed on the reflector lens, a load of 50 lb (22.7 kg) shall be applied, and the entire lens surface shall be rubbed 100 times.~~

~~After abrading the lens surface, the reflective intensity of each white reflecting surface at 0.2 degree divergence angle shall meet the following requirements when the incident light is parallel to the base of the reflector.~~

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~HORIZONTAL INCIDENT ANGLE~~	~~MINIMUM REFLECTIVE INTENSITY~~
~~0°~~	~~3.0 Candlepower/footcandle (0.279 cd/lx)~~
~~20°~~	~~1.2 Candlepower/footcandle (0.1115 cd/lx)~~

~~The reflective intensity for yellow reflectors shall be approximately 60% of the value for white. The reflective intensity for red reflectors shall be approximately 25% of the value for white. The reflective intensity for blue reflectors shall be approximately 10% of the value for white.~~

~~A sample consisting of 100 markers shall be submitted and 23 will be tested. The reflectors to be tested shall be located with the center of the reflecting face at a distance of 5 ft (1.5 m) from a uniformly bright light source having an effective diameter of 0.28 in. (7 mm). The photocell width shall be an annular ring 0.37 in. (9 mm) inside diameter and 0.47 in. (12 mm) outside diameter and shall be shielded to eliminate stray light. The distance from light source center to the photocell center shall be 0.21 in. (5 mm). If a test distance of other than 5 ft (1.5 m) is used, the source and receiver shall be modified in the same proportion as the test distance. Failure of more than 4% of the samples reflecting faces shall be the cause for rejection.~~

~~(2) Seal Test~~

~~A sample of 50 units shall be submerged in water at room temperature and subjected to a vacuum of 5 in. (125 mm) mercury for 5 min. After restoring atmospheric pressure, the units shall be left submerged for an additional 5 min. The unit shall be examined for water intake and failure of more than one unit shall be cause for rejection.~~

~~(3) Heat Resistance Test~~

~~Three reflectors shall be tested for 4 h in a circulating air oven at 175°F ± 5°F (80°C ± 3°C). The test specimens shall be placed in a horizontal position on a grid or perforated shelf permitting free air circulation. At the conclusion of the test the samples shall be removed from the oven and permitted to cool in air to room temperature. After exposure to heat, the samples shall show no significant change in shape and general appearance when compared with corresponding unexposed control standards. Failure of one or more units shall be cause for rejection.~~

~~(4) Strength Test~~

~~A random sample of three reflectors shall be selected for test purposes. The reflector base shall be positioned at the center of a flat steel plate which has a minimum thickness of 0.5 in. (13 mm) and a minimum outside diameter of 4.5 in. (114 mm). A load shall be applied to the top of the reflector through a 1 in. (25 mm) diameter by 1 in. (25 mm) high metal plug centered on the top of the reflector. The rate of loading shall be 0.2 in. (5 mm)~~

~~per minute. The reflector will be rejected if there is either breakage or significant deformation of the reflector at any load of less than 2000 lb (8896 N).~~

~~(5) Impact Test~~

~~The red lens shall not be subjected to impact test. A random sample of 20 lenses shall be selected from each lot of reflectors.~~

~~The reflectors shall be placed in a convection oven at 130°F (55°C) for 1 h. The reflectors shall be removed from the oven and the reflective face shall be immediately impacted by allowing a 0.42 lb (0.2 kg) dart fitted with a 0.25 in. (6 mm) radius spherical head to drop 18 in. (460 mm) perpendicularly onto the center of the reflective surface. Cracks in the impact area shall be concentric in appearance. There shall be no more than two radial cracks longer than 0.25 in. (6 mm). There shall be no radial cracks extending to the edge.~~

~~If 18 lenses of the test samples meet the above requirements, the lot shall be acceptable. Failure of four lenses of the sample shall be cause for rejection of the lot. If three lenses fail, a resample of 20 additional lens shall be tested for failure. Failure of more than one lens of the resample shall be cause for rejection of the lot.~~

~~(6) Temperature Cycling Test~~

~~A random sample of 20 lenses shall be selected from each lot of reflectors. The samples shall be subjected to three cycles of 140°F (60°C) for 4 h followed by 20°F (-7°C) for 4 h. There shall be no cracking nor delamination following temperature cycling.~~

~~If 18 lenses of the test sample meet the above requirements, the lot shall be acceptable. Failure of four lenses of the sample shall be cause for rejection of the lot. If three lenses fail, a resample of 20 additional lenses shall be tested for failure. Failure of more than one lens of the resample shall be cause for rejection of the lot.~~

~~(7) Adhesive Tensile Strength Test~~

~~A standard 4 in. by 2 in. by 0.46 in. (100 mm by 50 mm by 12 mm) reflector with pressure sensitive adhesive on the bottom shall be adhered to a flat 0.12 in. (3.0 mm) carbon steel test plate. The plate shall be primed in accordance with 921.02(d)1a, and the reflector shall be applied with a minimum application pressure of 60 psi (41 kPa). Both the top of the reflector and bottom of the flat plate shall have fastened to it an appropriate coupling device to ensure compatibility with the tensile testing device. The test sample shall then be tested in the tensile mode at 2 in. (50 mm) per minute pull rate. Minimum load to produce failure shall be 125 lb (566 N) at 70°F (21°C). Any load below 124 lb (566 N) is a failure and shall be cause for rejection of the lot.~~

~~(8) Basis For Use~~

~~The prismatic reflector shall be covered by a type B certification in accordance with 916.~~ *A type B certification in accordance with 916 shall be furnished for the epoxy material.*

~~**2. Cast Metal Base**~~

~~The base shall be a ductile iron casting made of modular iron in accordance with ASTM A 536, Grade 70-50-05 hardened to 52-54 RHC. The cast iron base shall be marked with the manufacturer's name and model number. The maximum dimensions shall be 2.00 in. (50 mm) high, 6 in. (152 mm) wide, and 10.0 in. (250 mm) long.~~

~~The exposed height of the casting after installation shall not exceed 0.50 in. (13 mm). The bottom of the casting shall have two parallel keels and a shaped web designed to fit into an accurately sawed, grooved slot in the pavement surface as shown on the plans.~~

~~a~~*1*. Epoxy Adhesive

The epoxy adhesive shall be in accordance with AASHTO M 237, type IV, Table 3 with respect to composition and performance. ~~For sampling purposes, a batch shall consist of a single charge of all components into a mixing chamber~~. *A type B certification in accordance with 916 shall be furnished for the epoxy material.*

~~**b. Basis For Use**~~

~~A type B certification in accordance with 916 shall be furnished for the epoxy material. A type C certification in accordance with 916 shall be furnished for the cast metal base for the pavement markers.~~

~~**3. Precast Cement Concrete Base**~~

~~The base shall be made of cement concrete with a compressive strength of 5000 psi (34.5 MPa) when tested in accordance with ASTM C 39. The maximum dimensions shall be 2.00 in. (50 mm) high, 6 in. (150 mm) wide, and 10 in. (254 mm) long. The maximum exposed height of the base after installation shall be 0.50 in. (13 mm).~~

~~**a. Adhesive for Precast Concrete Base**~~

~~This adhesive shall be quick setting magnesium phosphate concrete patching material with high strength and high bonding qualities. This material shall be used between 30°F (-1°C) and 90°F (32°C) and in thicknesses varying from 1/2 in. (13 mm) to full depth.~~

~~The material may be complete dry mix requiring only the addition of either water or a liquid activator just prior to mixing and use. The material shall not contain sufficient soluble chloride nor soluble sulfates to cause corrosion of reinforcement or damage to portland cement concrete.~~

~~The adhesive shall have an initial setting time of 10 min in accordance with ASTM C 266. The compressive strength shall be in accordance with ASTM C 109 and as listed.~~

~~TIME~~	~~COMPRESSIVE STRENGTH~~
~~2 h~~	~~1500 psi (10.3 MPa) min.~~
~~24 h~~	~~4000 psi (27.6 MPa) min.~~
~~7 days~~	~~6000 psi (41.3 MPa) min.~~

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~The adhesive shall have a durability factor of not less than 80 after being subjected to 300 cycles of the freeze and thaw test in accordance with ASTM C 666, Procedure B.~~

~~The adhesive shall be suitable for use with hand tools and shall not require special curing procedures.~~

~~b. Packaging~~

~~The patching material adhesive shall be packaged in strong moisture resistant bags or other suitable containers capable of withstanding normal shipping and handling without damage. The container shall protect the material from deterioration for a period of one year when stored in a dry condition. Mixing instructions shall be printed on each container.~~

~~c. Basis For Use~~

~~A type C certification in accordance with 916 shall be furnished for the precast cement concrete base. A type B certification in accordance with 916 shall be furnished for the marker adhesive patching material.~~

(e) ~~Glass~~ *Pavement Marking* Beads

~~Glass beads shall be in accordance with AASTHO M 247, type I except sampling shall be in accordance with the frequency manual. The beads shall have a moisture resistant coating.~~ *A type C certification in accordance with 916 shall be furnished for the beads*

1. ***Standard Beads.*** *Beads shall be glass in accordance with AASHTO M 247, Type I. The beads shall have a moisture resistant coating.*

2. ***Modified Standard Beads.*** *The modified standard beads shall be glass in accordance with AASHTO M 247, Type IM. These beads shall have a moisture resistant coating and may a have an adhesion promoting coating.*

3. ***Supplemental Beads.*** *The supplemental beads shall be glass in accordance with AASHTO M 247 except the beads shall have a minimum roundness of 80 percent by weight and the gradation shall be as follows:*

Sieve Size	*Percent Passing by Weight*
No. 10 (2.0 mm)	*100*
No. 12 (1.7 mm)	*95 – 100*
No. 14 (1.4 mm)	*80 – 95*
No. 16 (1.18 mm)	*10 – 40*
No. 18 (1.0 mm)	*0 – 5*
No. 20 (850 µm)	*0 – 2*

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

These beads shall a have a moisture resistant coating and may have an adhesion promoting coating.

4. Supplemental Elements. *These shall be for color, skid resistance, or wet weather retro-reflectivity and may be used provided they do not exhibit a characteristic of toxicity referenced in AASHTO M 247. A type D certification in accordance with 916 shall be furnished for the supplemental elements.*

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A

76-3.0 PAVEMENT MARKING MATERIALS

76-3.01 Material Types

~~INDOT is presently using several types of pavement marking materials. Recommended locations for each pavement marking types are presented in Section 76-3.02. All pavement marking~~ materials ~~must meet the criteria set forth in the Indiana Standard Specifications.~~ The pavement marking materials used by INDOT are described below:

1. Paint. Quick-drying paints are typically, applied as a 100-mm or wider white or yellow stripe. Glass beads are dropped onto the wet paint which then bond to the paint surface when it dries. The use of glass beads greatly enhances the reflectivity of the paint stripe. Per unit cost, paint-applied markings are significantly cheaper than any other method. One of the major disadvantages of paint is that it can be quickly worn away on high- volume roadways and, therefore, often needs to be reapplied more than once a year.

2. Thermoplastic. Thermoplastic markings are typically made from hydrocarbon or alkyd resins, pigment and filler. The materials are heated to high temperatures and are applied in thicknesses of ~~2~~*.42.3* mm to ~~4~~*.83.2* mm. The material is applied to the surface and, while it is still hot, glass beads are dropped onto the mixture. When the material cools, the glass beads are then bonded to the surface. Thermoplastic markings must be applied to clean, dry bituminous pavements. A primer may be required to ensure satisfactory performance. Thermoplastic markings are ~~significantly~~ more expensive than paint, but often can last ~~5~~3 or more years when applied properly. ~~Thermoplastic is the preferred marking for high-volume roadways due to its long life.~~

3. ~~Epoxy Paint~~*Multi-Component*. ~~Epoxy~~*Multi-Component* markings typically are made from a two-component epoxy resin, pigment, extenders and fillers. The two epoxy resin components are mixed together just prior to being applied to the roadway surface. The two epoxy components produce a chemical reaction which binds them together. Materials using this type of chemical reaction are called thermoset materials. ~~Epoxy~~*Multi-component* markings typically are applied in thicknesses of 0.~~3~~*5* mm to 0.~~5~~*7* mm and can be applied even to wet pavements. Glass beads are typically dropped onto the mixture; however, they may be applied by several different means depending on the ~~epoxy~~*multi-component* material types used.

4. Preformed Plastic. Preformed plastic markings are typically premade in a factory from vinyl, pigment and fillers and can come in strips, words or symbols. Glass beads are commonly embedded into the surface of the markings at the factory. Application of the marking typically involves removing a protective strip, laying the marking in place and applying pressure with a roller. Temporary tapes are commonly used in construction zones because the tapes can be easily removed.

However, a common problem with some temporary preformed plastics is that they tend to break up easily and must be routinely checked for adequacy.

5. Raised Pavement Markers. Raised pavement markers (RPM's) are typically cube-cornered acrylic lenses, tempered-glass lenses, or glass-bead lenses, mounted in either a plastic or iron base. They are commonly placed with an. adhesive to either the pavement surface or into a precut groove. For temporary applications, they may be placed in a plastic base and applied directly to the pavement with an adhesive. RPM's are designed to reflect the striping colors (e.g., white, yellow, red) and are used as a supplement to other markings and as position guidance devices. To enhance the service life, recessed markers are designed to allow a snow plow to pass over the marker.

6. Experimental Markings. With the continued advancement of technology in pavement markings, there will always be new materials or methods available in the placement of pavement markings. The designer is encouraged to pursue the use of these new materials or procedures. However, the use of any experimental pavement marking material on State-maintained facilities must be first approved by the ~~Division of Operations Support~~*Highway Operations Division.*

76-3.02 Applications

Figure 76-3A provides the recommended applications for the various pavement markings used by the Department. The following sections provide additional guidance on the application of these various pavement marking materials. For the purpose of the following sections, special markings include, but are not limited to crosswalks, railroad crossings, stop lines, pavement words and symbol markings.

For projects with longitudinal marking lengths exceeding those described in Section 808.07(c) of the INDOT Standard Specifications, the pay item Retro-Reflectivity Testing, should be included in *the contract.*

76-3.02(01) Paint

Paint should be used at all locations where it can provide good, year-round visibility and where the additional cost of durable pavement markings cannot be justified. In general, paint should be used:

1. on all roads or streets where the average daily traffic is less than 1000 vehicles per lane;

2. where the remaining surface life of the pavement is less than three years, or where the pavement is scheduled for resurfacing within three years; and/or

3. for marking non-mountable islands and raised curbs.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A (CONTINUED)

76-3.02(02) Thermoplastic

Hydrocarbon and alkyd thermoplastic markings may be used on bituminous pavement under the following conditions:

1. Travel Way Lines. Thermoplastic markings may be used for center lines, *edgelines* and lane lines at locations that are not proposed or scheduled for resurfacing within the next ~~four~~*three* years *and where the average daily traffic is in excess of 1000 vehicles per lane.* ~~Thermoplastic markings are typically not used for edge lines, unless they can be broken for drainage.~~

2. Special Markings. Thermoplastic markings may be used for locations that are not proposed or scheduled for *resurfacing* within the next three years and where the average daily traffic is in excess of 1000 vehicles per lane.

3. Painting Cycles. Thermoplastic markings may be used on any road that normally requires two or more *paintings* per year, or on roads which are normally painted only once a year and the minimum average daily traffic exceeds 3500 vehicles per lane.

4. Decision Points. Thermoplastic markings may be used where there is a need for a more positive lane *identification* because of alignment, transitions or channelization.

76-3.02(03) ~~Epoxy Paint~~*Multi-Component*

~~Epoxy~~*Multi-Component* markings may be used for center lines, lane lines and edge lines. They are generally not used for special markings or for marking non-mountable islands and raised curbs because of problems that can develop with the intermittent application: ~~Epoxy~~*Multi-Component* markings may be used:

1. at locations where the *average* daily traffic is in excess of 1000 vehicles per lane, and the

location is not proposed or scheduled for resurfacing within the next three years; and/or

2. if the location is not proposed or scheduled for resurfacing within the next two years on any road that normally requires two or more paintings per year,or on any road that is normally painted only once a year and the minimum average daily traffic exceeds 3500 vehicles per lane.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A (CONTINUED)

76-3.02(04) Preformed Plastic *and Extended Warranty Preformed Plastic*

In general, the criteria for ~~epoxy~~*multi-component* markings presented in Section 76-3.02(03) is also applicable for permanent applications of preformed plastic markings.~~; however, they should only be used where:~~

~~1. there is highway illumination;~~
~~2; they can be supplemented by RPM's; or~~
~~3.~~ *Also* they are permitted, by special provisions, on bridge overlay projects.

Extended warranty preformed plastic markings have better durability and retained retro-reflectivity, increased detection distance, and some wet retro-reflectivity characteristics. However, these markings are more expensive due to material and installation costs. In order to take full advantage of the performance properties, the material is preferably installed either inlayed into HMA during finish rolling or overlaid into HMA or PCCP which is grooved to receive the marking. An ideal application is for center skips for divided highways or interstates in order to have a competitive life-cycle cost.

Temporary preformed plastic markings are commonly used in construction zones. Temporary preformed plastic markings should not be used for permanent applications.

76-3.02(05) Raised Pavement Markers (RPM's)

Snowplowable RPM's provide a supplemental method of delineation and are positive position guidance devices. They should not be used as a replacement for standard pavement markings or conventional roadside delineation. The INDOT *Standard Drawings* provide details on the placement and color locations for RPM's. In addition, the following placement considerations should be reviewed:

1. Location. Site selection should be based primarily on the need for additional alignment delineation specifically in areas of frequently inclement weather (e.g., fog, smoke, rain) and in areas of low roadway illumination. Typical areas that should be considered for placement of RPM's include areas where vehicles are leaving the roadway,, areas showing excessive wear of existing pavement markings, areas with excessive skid marks, interchange ramps, etc.

2. Pavement Life. RPM's *generally* should not be placed at locations that are scheduled for resurfacing or reconstruction within the next four years.

3. Illumination. RPM's may *not* be required at locations that are illuminated.

4. Traffic Volumes. RPM's should be considered where traffic volumes exceed 2500 ADT for 2-lane roadways and 6000 ADT for 4-lane roadways. On lower volume

roads, an engineering investigation should be conducted to determine whether RPM' s may be appropriate to supplement the standard traffic control devices.

5. Spacing. The normal spacing for RPM's on tangent sections is 24 m. Spacing for center line RPM's used iii conjunction with no-passing zones may be reduced to 12 m. Six RPM's at 12-m spacing (72 m) may be used in advance of and following any delineated no-passing zone. Consideration should be given to connecting two locations or *zones* of RPM's where the distance between them is less than 900 m. See the INDOT Standard Drawings for additional details for spacings at other locations.

6. Special Locations. Typically, RPM's should not be used exclusively for edge lines or gore markings. RPM's may be allowed at pavement transitions, 1-way and narrow bridges, special channelization areas, or in other areas where there is strong justification for *installation* of these devices.

76-3.02(06) Surface Conditions

In general, most pavement markings can be used with both bituminous and concrete pavements. It should be noted, however, that pavement markings on bituminous surfaces tend to last longer than those on concrete surfaces. Hot applied thermoplastic pavement marking materials should not be placed on concrete surfaces.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A (CONTINUED)

Application [1]	Material Types					
	Paint	Thermoplastic	~~Epoxy~~ *Multi-Component*	Preformed Plastic	*Ext. Warranty Preformed Plastic*	Raised Pavement Markers
ADT per lane	<1000	>1000	>1000	>1000	*>6000*	>2500 2-lane >6000 4-lane
Pavement Surface Life	<3 Years	≥4*3* Years	≥3 Years	≥3 Years	*≥4 Years*	≥4 Years
Edge Lines	x	x~~2~~	x	x		x
Center Lines	x	x	x	x		x
Special Markings	x	x		x		
Concrete Pavements	x		x	x	*x*[2]	x
Bituminous Pavements	x	x	*x*	x	*x*[2]	x

1 *Other applications or restrictions may apply; see Section 76-3.02 for additional information.*

~~2 *Edge lines must be broken for drainage purposes.*~~

2 Skip lines only

RECOMMENDED PAVEMENT MARKINGS APPLICATIONS

Figure 76-3A

INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT

MEASUREMENT OF RETROREFLECTIVE PAVEMENT MARKING MATERIALS ITM No. 931-08T

1.0 SCOPE.

1.1 This procedure covers the measurement and acceptance of retroreflectivity on pavement markings using portable hand-operated instruments.

1.2 The purpose of this test method is to assure that adequate retroreflectivity of horizontal pavement markings is provided by newly applied markings for the driver of a vehicle.

1.3 Newly applied pavement markings are those which have been applied between 14 to 30 days before testing and from which all excess glass spheres have been removed. Excess glass spheres contribute to erroneous readings directly after application and are generally not present a few days after application.

1.4 The coefficient of variation allows the Department to determine whether the marking shall be reapplied even if the average exceeds the minimum requirements. A coefficient of variation greater than 30% indicates that the appearance of the marking will be non-uniform and may cause problems for the nighttime visibility of the driver.

1.5 The values stated in either acceptable English units or SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore, each system will be used independently of each other, without combining values in any way.

1.6 This procedure may involve hazardous materials, operations, and equipment, and may not address all of the safety problems associated with the use of the ITM. The ITM user should follow appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.7 *Retroreflectivity measurements shall be performed at all times by an operator trained and certified by the retroreflectometer unit manufacturer's authorized* representative*. Such certification shall be valid for a period not*

to exceed 2 years from the date of training. A copy of the operator's current certificate shall be provided to the Engineer prior to the start of work.

2.0 REFERENCES.

2.1 ASTM Standards.

E 1710 Standard Test Method for Measurement of Retroreflective Pavement
Marking Materials with CEN-prescribed Geometry Using a Portable Retroreflectometer

2.2 ITM Standards.

802 Random Sampling

3.0 TERMINOLOGY. Definitions for terms and abbreviations will be in accordance with the, Section 101 of the Department's Standard Specifications and the following:

3.1 Section. The application of each color of pavement marking completed by one application crew in one day.

3.2 Segment. A portion equal to one third of the pavement marking application of a day.

3.3 Sampling Zone**.** A location within each segment that retroreflectivity readings are taken.

3.4 CEN Geometry**.** The geometry of instrument measurement specified by CEN, based on a viewing distance of 30m from an arbitrary passenger vehicle with an eye height of 1.2m and a single headlight mounting height of 0.65m in the same vertical plane and a pavement stripe directly ahead of the headlight.

3.5 Retroreflectivity. A standard of measure for pavement markings. The units for these measurements are millicandelas per square meter per lux.

4.0 SIGNIFICANCE AND USE. The test method is used to determine retroreflective properties of horizontal pavement marking materials containing retroreflecting beads, such as traffic stripes and surface symbols, using a portable retroreflectometer that may be placed on the road delineation to measure the retroreflection at a prescribed geometry.

5.0 APPARATUS.

5.1 Retroreflectometer, Delta Model LTL 2000 or LTLX., in accordance with ASTM D 1710 The measurement geometry used will be 88.76° for the entrance angle β1, 0° for β2, and 1.05° for the observation angle. The aperture angles for both the source and receiver will not exceed 0.33°.

A factory calibration shall be performed on the retroreflectometer at a minimum of once per calendar year. *A copy of such calibration documentation shall be provided to the Engineer prior to the star of work.*

If desired, a contractor may schedule a time to bring his retroreflectometer to an INDOT location for comparison measurements with an INDOT unit.

6.0 SAMPLING. Each sampling zone for retroreflectivity measurement will be determined as follows:

6.1 Longitudinal Lines.

6.1.1 Divide the number of miles of each color of pavement marking application completed in a single day work by three to establish the length of each segment.

6.1.2 In each segment, the Engineer will randomly generate a point to the nearest tenth of a mile to begin taking measurements of the sampling zone area in accordance with ITM 802.

6.2 Letters, Symbols, and Transverse Lines.

6.2.1 Each letter, symbol, or transverse line is considered a sampling zone area.

7.0 PROCEDURE.

7.1 Use the manufacturer's instructions for operation of the retroreflectometer.

7.1.1 Ambient temperature shall be not less than 40°F (4°C).

7.1.2 The surface of the marking shall be clean and dry.

7.1.3 Transporting the instrument from an air conditioned area to the test site may result in fogging of mirrors in the instrument. If there is any doubt concerning the calibration or the readings are not

constant, allow the instrument to reach ambient conditions and recalibrate with the instrument standard.

7.1.4 Turn on the retroreflectometer, and allow the device to reach equilibrium following the manufacturer's instructions.

7.1.5 Subsequent to standardization, an internal or secondary reference surface such as diffuse white or retroreflecting surface is used to maintain the standardization of the instrument during brief periods of transport to the test site area.

7.2 Zero and calibrate the hand-operated instrument. Print the zero and calibration readings at the beginning of the days work. Recalibrate the instrument every 2h when taking readings. Print the zero and calibration readings each time these operations are performed. The instrument zero and calibration are to be in accordance with the instrument manufacturers written instructions.

7.3 All measurements obtained in the sampling areas listed as follows will be made in the direction of traffic flow. On the centerline of two-lane roads, the required number of measurements will be made for each line in each direction of the single and double centerlines.

7.4 Longitudinal Lines.

7.4.1 Make 20 retroreflectivity measurements within each sampling zone of each longitudinal line. Make the first measurement exactly at the beginning of the sampling zone. Take subsequent measurements at approximately 15ft intervals. If any portion of the sampling zone is unsafe for taking measurements, then move forward to the first point which may be inspected safely and begin the sampling zone there. Do not move the sampling zone simply for convenience. A change in the starting point of one sampling zone should not change the starting points of any subsequent sampling zone. If a valid measurement is not attainable at a location within the sampling zone due to a pothole, grass, obvious tracking, etc., move forward in the sampling zone to the first available location for a valid measurement, then resume the subsequent measurements within that sampling zone in the incremental procedure described above. For measurements taken on centerlines, take alternating readings between solid lines or on the combination of solid and skip lines.

7.4.2 When a sampling zone contains only skip lines for evaluation. Measure each skip line at two evenly spaced locations on the line.

Continue measuring within the established sampling zone in this manner until 20 readings are obtained.

7.5 Letters, Symbols and Transverse Lines.

7.5.1 A minimum of ten random measurements will be made on each letter, symbol, or transverse lines which are 8ft (2.4m) tall or wide. A minimum of five random measurements on each letter, symbol, or transverse lines smaller than 8ft (2.4m) will be made.

8.0 CALCULATIONS.

8.1 Calculate the average, standard deviation and coefficient of variation for each sampling zone, segment, and section as follows:

Average $(\bar{x})$

$$\bar{x} = \sum_{i=1}^{n} \frac{x_i}{n}$$

Standard Deviation (s):

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

Coefficient of Variation $= \frac{s}{\bar{x}} \times 100$

where:

n = the number of measurements within each measurement sampling zone

9.0 REPORT. The report shall include the following items:

9.1 Test date and time

9.2 Date and time of application of the pavement marking

9.3 Color of and type of pavement marking

9.4 Manufacture and product name or number of each material used

9.5 The location road, route number, reference points, direction of traffic, line identification, and other designated information

9.6 All measurements reported in millicandelas per square meter per lux for each sampling zone of each traffic direction for each longitudinal lane marking or each letter, symbol, and transverse line

9.7 The average and coefficient of variation of the measurements for each sampling zone, segment, and section

9.8 The serial number and date of last factory calibration for the retroreflectometer

9.9 Each of the zero and calibration readings

~~**10.0 ACCEPTANCE CRITERIA.**~~

~~**10.1 Longitudinal Lines.**~~

~~**10.1.1** When 18 of the individual measurements and the average in a sampling zone meet or exceed the required minimum retroreflectivity values for the pavement marking materials which are being measured, the segment that is being evaluated will be accepted.~~

~~**10.1.2** When more than 5 of the 20 measurements taken within a sampling zone fail to meet the minimum retroreflectivity requirements established for the pavement markings which are being measured, the segment is not accepted and additional testing within that segment is not required.~~

~~**10.1.3** If less than 18 and more than 15 of the individual measurements within a sampling zone meet or exceed the required minimum retroreflectivity values established for the pavement markings which are being measured, additional measurements will be taken within the segment that is being evaluated. When additional measurements are required, the Engineer will randomly establish two new sampling zones within the segment in question using the procedure detailed in 6.1.2. Obtain measurements for each of these sampling zones as described in 7.1 to 7.4.2. These measurements will be combined with the initial measurements for evaluation of the segment. If less than 54 of the 60 measurements, 20 in each of three sampling zones, or the average taken within a segment fail to meet the minimum retroreflectivity requirements established for the pavement markings which are being measured, the segment is not accepted.~~

10.1.4 When more than one of three segments is not accepted on a section of longitudinal pavement marking, the entire section of pavement markings will not be accepted.

10.1.5 When the coefficient of variation is greater than 30% for any sampling zone, segment, or section, the entire section of pavement marking will not be accepted.

10.2 Letters, Symbols, and Transverse Lines.

10.2.1 When 90% of the readings in a sampling zone meet or exceed the required minimum retroreflectivity values and the average of the sampling zone meets or exceeds the retroreflectivity values established for the pavement marking materials that are being measured, the letter, symbol or transverse line which is being evaluated will be accepted.

10.2.2 When more than 25% of the individual measurements taken within a sampling zone fail to meet the minimum retroreflectivity established for each of the letters, symbols, or transverse lines which are being measured, the letter, symbol, or transverse marking will not be accepted and additional measurements are not required.

10.2.3 If less than 90% but more than 75% of the individual measurements taken within a sampling zone fail to meet the minimum retroreflectivity requirements for each of the letters, symbols, or transverse markings which are being measured, the letter, symbol, or transverse line and additional measurements will be taken within the sampling zone that is being evaluated. When additional measurements are required, randomly take twice the number of measurements as required in 7.5.1 on each letter, symbol or transverse line. These measurements are to be combined with the initial measurements for each letter, symbol, or transverse line. If less than 90% of the total combined individual measurements or the average of all measurements for each of the markings taken within a sampling zone fails to meet the minimum retroreflectivity requirements established for the letter, symbol, or transverse line which are being measured, the pavement marking is not accepted.

10.2.4 When the coefficient of variation is greater than 30% for any letter, symbol, or transverse line, the specific letter, symbol, or transverse line will not be accepted.

REVISION TO THE STANDARD SPECIFICATIONS

BACKUP NO. 1: RECURRING SPECIAL PROVISION
808-R-551 PERFORMANCE BASED PAINT PAVEMENT MARKINGS
(INCLUDED IN PROPOSED REVISION TO SECTION 808)

808-R-551 PERFORMANCE BASED PAINT PAVEMENT MARKINGS

(Revised 11-21-08)

The Standard Specifications are revised as follows:

SECTION 109, AFTER LINE 808, INSERT AS FOLLOWS:

(f) Pavement Traffic Markings, PTM

Quality adjustments will be calculated in accordance with 808.07.

SECTION 808, DELETE LINES 142 THROUGH 172.

SECTION 808, AFTER LINE 173, INSERT AS FOLLOWS:

(a) Traffic Paint

1. Traffic Paint Pavement Markings

These traffic paint markings shall be used for temporary pavement markings or when performance based markings are not specified.

a. Application

Fast dry traffic paint shall be applied only when the pavement temperature is 40°F (5°C) or above. Waterborne traffic paint shall be applied only when the pavement temperature is 50°F (10°C) or above. Fast dry traffic paint will only be permitted between October 1 and the following April 30. Cold temperature waterborne traffic paint shall be applied only when the pavement and ambient air temperature is a minimum of 35°F (2°C) and rising.

The wet film thickness of the traffic paint shall be a minimum of 15 mils (380 µm). Painted lines and markings shall be immediately reflectorized by applying glass beads at a uniform minimum rate of 6 lb/gal. (0.7 kg/L) of traffic paint.

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

b. Equipment

Traffic paint shall be applied with a spray type machine capable of applying the traffic paint under pressure through a nozzle directly onto the pavement. The machine shall be equipped with the following:

(1) an air blast device for cleaning the pavement ahead of the application;
(2) a guide pointer to keep the machine on an accurate line;

(3) spray guns which can be operated individually or simultaneously;
(4) agitator(s);
(5) a control device to maintain uniform flow and application;
(6) capability of heating the material to application temperatures;
(7) an automatic device which will provide a line of the required pattern; and
(8) an automatic glass bead dispenser which is synchronized with the marking application.

A small hand propelled machine, designed for that purpose, may be used to apply pavement markings. A brush may be used if approved to apply some markings.

2. Performance Based Traffic Paint Pavement Markings

The performance based traffic paint pavement markings consist of furnishing and applying longitudinal markings of waterborne traffic paint and glass beads, to HMA and PCC pavements. The markings shall only be applied when conditions meet or exceed the manufacturer's recommendations. The markings shall meet or exceed all performance requirements.

a. Materials

The waterborne traffic paint and glass beads shall be commercially available traffic marking materials which shall be chosen by the Contractor and will not be required to meet the material specifications found in 909.05 or 921.02(e). A certification which shows the paint meets all IDEM and EPA regulatory requirements for VOC levels and lead, chromium or other heavy metals from the paint manufacturer shall be provided. The daytime and nighttime color of the applied markings shall be in accordance with ASTM D 6628 when determined in accordance with ASTM E 811 and E 1349. Acceptance of the materials will also be based on the performance of the applied markings.

b. Application Requirements

The paint manufacturer's recommendations shall be followed in regard to all requirements during application and curing of the pavement markings. The pavement markings shall be protected from traffic until dry to eliminate tracking. The application equipment shall be in accordance with 808.07(a)1b.

The application rates utilized for the paint and glass beads are at the discretion of the Contractor provided the minimum wet film thickness of the applied paint is 15 mils and the minimum application of glass beads is 6 pound per gallon of paint. The number of applications of paint and beads shall be as necessary to meet the performance requirements.

REVISION TO THE STANDARD SPECIFICATIONS

BACKUP NO. 1: RECURRING SPECIAL PROVISION
808-R-551 PERFORMANCE BASED PAINT PAVEMENT MARKINGS
(INCLUDED IN PROPOSED REVISION TO SECTION 808) (CONTINUED)

c. Performance Requirements

(1) Retro-reflectivity

The painted centerlines and/or edgelines shall meet or exceed minimum average retro-reflectivity measurements. The white pavement markings shall provide a minimum average retro-reflectivity of 250 mcd/m^2/lx. The yellow pavement markings shall provide a minimum average of 175 mcd/m^2/lx.

If a pay item, retro-reflectivity testing is included in the contract and performance based traffic paint is specified, retro-reflectivity testing equipment shall be furnished, calibrated, and operated in accordance with ITM 931. The markings shall be tested in a period of not less than 14 days to not more than 30 days after the materials are applied. The retro-reflectivity equipment shall remain the property of the Contractor. The Contractor shall submit a report as described in ITM 931, including the specified test results and calculations, to the Engineer within 3 business days of each day of testing.

When retro-reflectivity testing is not included as a pay item, the Department will furnish, calibrate, and operate the testing equipment in accordance with ITM 931. The markings will be tested in a period of not less than 14 days to not more than 30 days after the materials are applied.

(2) Durability

The pavement markings shall have a minimum resistance to wear of 97% in accordance with ASTM D 913 for a minimum of 90 days after application.

d. Retro-reflectivity Quality Assurance Adjustments

Pavement markings that fail to meet the minimum average retro-reflectivity will have quality adjustments applied to the payment of the markings as follows:

White	*Yellow*	*Quality Adjustment*
>250 mcd/m^2/lx	*>175 mcd/m^2/lx*	*1.00*
225 to 249	*-*	*0.95*
200 to 224	*150 to 174*	*0.90*
175 to 199	*-*	*0.85*
150 to 174	*125 to 149*	*0.80*
125 to 149	*-*	*0.75*
100 to124	*100 to 124*	*0.70*

Pavement marking segments which are found to have an average retro-reflectivity reading of below 100mcd/m^2/lx shall be re-striped with no additional payment. The re-striping shall begin within 14 calendar days of the completion of the retro-reflectivity measurement. Line segments of white pavement markings which have retro-reflectivity

REVISION TO THE STANDARD SPECIFICATIONS

BACKUP NO. 1: RECURRING SPECIAL PROVISION
808-R-551 PERFORMANCE BASED PAINT PAVEMENT MARKINGS
(INCLUDED IN PROPOSED REVISION TO SECTION 808) (CONTINUED)

measurements between 100 and 249mcd/m^2/lx may be re-striped with no additional payment. Line segments of yellow pavement markings which have retro-reflectivity measurements between 100 and 175mcd/m^2/lx may be re-striped with no additional payment. Following each re-striping, additional retro-reflectivity measurements will be made at no additional payment. Quality assurance adjustments will be based on the final retro-reflectivity measurements. The alignment of all re-striped pavement markings shall be placed within ±0.25 inches in width and ±2.0 inches in length of the original placed markings. No more than two re-stripings will be permitted. If the final average retro-reflectivity measurements is below 100 mcd/m²/lx or the alignment or color tolerances are not in compliance the segment of line will be adjudicated as failed material in accordance with 105.03.

SECTION 808, AFTER LINE 484, INSERT AS FOLLOWS:

Retro-reflectivity testing will not be measured for payment.

SECTION 808, AFTER LINE 525, INSERT AS FOLLOWS:

Payment for furnishing, calibrating, and operating retro-reflectivity testing equipment will be paid for at the contract lump sum price if the Schedule of Pay Items includes a lump sum pay item for retro-reflectivity testing. The cost of report preparation shall be included in the cost of retro-reflectivity testing. Adjustments to the contract payment with respect to retro-reflectivity of performance based pavement markings will be included in a quality assurance adjustment pay item in accordance with 109.05.1. If the retro-reflectivity testing cannot be performed per ITM 931 due to weather limitations only, the testing requirement may be waived and payment made at 100% provided that all other requirements are met and no payment will be made for retro-reflectivity testing.

SECTION 808, AFTER LINE 536, INSERT AS FOLLOWS:

Line, Performance Based, _____, _____, _____, _____ in. (mm) ..... LFT (m)
material type color width

SECTION 808, AFTER LINE 541, INSERT AS FOLLOWS:

Retro-reflectivity Testing ..... LS

SECTION 909, AFTER LINE 516, INSERT AS FOLLOWS:

(d) Cold Temperature White and Yellow Waterborne Traffic Paint

The cold temperature white and yellow waterborne traffic paint shall consist of an emulsion of pigmented binder formulated to be applied and cure at air and pavement temperatures above 35°F (2°C). The cold temperature waterborne traffic paints shall be in accordance with 909.05(c) except for the application temperature and no-tracking condition requirements.

COMMENTS AND ACTION

REVISION TO SECTION 109.05.1 QUALITY ADJUSTMENTS
REVISION TO SECTION 801.12(a) TEMPORARY PAVEMENT TRAFFIC METHODS
REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS
REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT
REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS
REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A
REVISION TO ITM No. 931-08T

Motion:
Second:
Ayes:
Nays:

Other sections containing specific cross references:

Section 109.05.1 with:
401.22 Pg.249; 501.31 Pg. 305

Section 808 with:
108.08 Pg.84; 604.04 Pg.366;
801.12 Pg.665,666;
801.14 Pg.667;
801.17 Pg.672;
801.18 Pg.673,674;

Section 909.05 with:
808.02 Pg.724; 808.07 Pg.727;
604.05 Pg.363; 921.01 Pg.923

Section 921 with:
801.02 p.653; 808.02 p.724

Recurring Special Provision affected:
808-R-551
808-T-141
808-T-151
808-B-114

Standard Sheets affected:
None

Action:
____ Passed as Submitted
____ Passed as Revised
____ Withdrawn

____ 20__ Standard Specifications Book

____ Create RSP (No.____)
Effective ____Letting
RSP Sunset Date: ____

____ Revise RSP (No.____)
Effective ____Letting
RSP Sunset Date: ____

Standard Drawing Effective ____
____ Create RPD (No. ____)
Effective ____Letting
____ Technical Advisory

GIFE Update Req'd.? Y ____ N ____

By ____ Addition or ____ Revision

Frequency Manual Update Req'd? Y__N__
By ____ Addition or ____ Revision

Received FHWA Approval? ____

Mr. Heustis
Date: 12/17/09

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: 401.18 includes language which appears to give the Contractor the ability to designate the method to measure pavement smoothness in situations where the posted speed limit is 45 mph or less. The Department should determine the level of smoothness desired for its pavements. Also, for budgetary reasons, the Department needs to be able to determine on which contracts the Contractor will have the opportunity to earn a smoothness bonus. In addition, some District Construction personnel have indicated that there has been some confusion regarding who is responsible for performing of the straightedge operation.

PROPOSED SOLUTION: Attached revised specifications. If passed by the Standards Committee, these proposed changes can be incorporated into RSP 400-R-553. In addition, if passed by the Standards Committee, proposed revisions to ITM 912 will be forwarded to the ITM Committee for consideration.

APPLICABLE STANDARD SPECIFICATIONS: 401.18, 401.19 (c)

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: Chapter 52

APPLICABLE SECTION OF GIFE: Section 13

APPLICABLE RECURRING SPECIAL PROVISIONS: 400-R-553

Submitted By: Ron Heustis/Jeff James

Title: Field Engineer

Organization: INDOT

Phone Number: 317/232-5082

Date: October 21, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? The proposed revisions were initially discussed at an INDOT/APAI Committee meeting. Additional comments were provided by INDOT Division of Construction Management and District Construction personnel.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS (CONTINUED)

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 405, DELETE AND INSERT AS FOLLOWS:

401.18 Pavement Smoothness

~~The p~~*P*avement smoothness will be accepted by means of a profilograph, a 16 ft (4.9 m) long straightedge, or a 10 ft (3 m) long straightedge *as described below*.

(a) Profilograph

When a pay item for Profilograph, HMA is included in the contract, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 912 on the mainline traveled way and ramps, including adjacent acceleration or deceleration lane, where all of the following conditions are met:

~~The profilograph shall be used where all of the following conditions are met:~~

~~(a)~~*1)* ~~t~~*T*he design speed is greater than 45 mph (70 km/h)

~~(b)~~*2)* ~~t~~*T*he ~~pavement~~ *traveled way or ramp* lane~~s are~~ *width* is ~~full~~ *constant* ~~width~~ and *is* 0.1 mi (0.16 km) *in length* or longer~~, and~~.

~~(c)~~*3)* ~~t~~*T*he HMA is placed on a milled surface or the total combined planned lay rate of surface, intermediate, and base *courses* is 385 lb/syd (210 kg/m^2) or greater.

~~If a pay item, Profilograph, HMA, is included in the contract and the above conditions are met, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 912.~~ The profilogram produced shall become the property of the Department. The profilograph shall remain the property of the Contractor. ~~When a profilograph, HMA, is not included as a pay item, and the above conditions are met, the Department will furnish, calibrate, and operate the profilograph or the Department will develop a change order in accordance with 109.05 to include profilograph, HMA as a pay item.~~

~~Within the limits of a smoothness section where the posted speed is 45 mph (70 km/h) or less, smoothness of that section may be measured by a profilograph or a 16 ft (4.9 m) long straightedge. The Contractor shall notify the Engineer of the selected process prior to placement of the HMA. Smoothness pay adjustments are only applicable when measured by a profilograph.~~

The project area, less paving exceptions and areas exempt from profilograph operation in accordance with ITM 912, will be divided into individual smoothness sections measuring 0.1 mi (0.16 km) in length for each lane. Partial length smoothness sections adjacent to project limits, paving exceptions, or areas exempt from profilograph operation will be considered in accordance with ITM 912.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS (CONTINUED)

If the posted speed limit for an entire smoothness section is less than or equal to 45 mph, the section will be exempt from profilograph operation and the smoothness within the section will be accepted by a 16 ft (4.9 m) straightedge.

If the posted speed limit is greater than 45 mph for a portion of a smoothness section and is less than or equal to 45 mph for the remainder, the section smoothness acceptance will be as follows:

1) *By profilograph for the portion of the section with a posted speed limit greater than 45 mph.*

2) *By profilograph or 16 ft (4.9 m) straightedge for the portion of the section with a posted speed limit less than or equal to 45 mph at the Contractor's option. The Contractor shall notify the Engineer of the selected option prior to beginning the paving operation in the smoothness section.*

At locations where the profilograph is required, it shall be used on surface and dense graded intermediate courses.

(b) 16 ft (4.9 m) Straightedge and 10 ft (3 m) Straightedge

The Department will furnish and operate 16 ft (4.9 m) and 10 ft (3 m) straightedges as described below. The 16 ft (4.9 m) straightedge is used to accept smoothness along the direction of mainline traffic and the 10 ft (3.0 m) straightedge is used to accept smoothness transverse to the direction of mainline traffic. This includes longitudinal smoothness on public road approaches and median crossovers. The Contractor shall provide all traffic control required for the operation of straightedges.

For contracts which include the Profilograph, HMA pay item, the 16 ft (4.9 m) long straightedge will be used to accept longitudinal smoothness on all dense graded courses at the following locations:

1) *All mainline traveled way lanes shorter than 0.1 mi (0.16 km).*
2) *All mainline traveled way lanes within smoothness sections with posted speed limits less than or equal to 45 mph throughout the entire section length.*
3) *All mainline traveled way lanes at locations exempted from profilograph operation in accordance with ITM 912.*
4) *All tapers.*
5) *All turn lanes, including bi-directional left turn lanes.*
6) *All ramps with design speeds of 45 mph (70 km/h) or less.*
7) *All acceleration and deceleration lanes associated with ramps with design speeds of 45 mph (70 km/h) or less.*
8) *All shoulders.*

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS (CONTINUED)

The 16 ft (4.9 m) straightedge will be used to accept longitudinal smoothness on all dense graded base courses at locations where profilograph use is required on overlying courses.

For contracts where the profilograph is not used for smoothness acceptance, the 16 ft (4.9 m) straightedge will be used to accept longitudinal smoothness on all dense graded courses at the above locations as well as all mainline travel way lanes and ramps with design speeds of greater than 45 mph (70 km/h). Smoothness acceptance on ramp acceleration or deceleration lanes will also be based on operation of the 16 ft (4.9 m) straightedge.

~~The 16 ft (4.9 m) long straightedge is used to check longitudinal profile and shall be used on all overlays where the profilograph is not specified. For contracts that include a profilograph item, the 16 ft (4.9 m) long straightedge shall be used on shoulders, on all full width pavement lanes shorter than 0.1 mi (0.16 km), in length, on tapers, within 50 ft (15 m) of a reinforced concrete bridge approach, and within 50 ft (15 m) of an existing pavement, which is being joined.~~

For all contracts, a 10 ft (3 m) straightedge will be used for smoothness acceptance for all dense graded courses used for all mainline traveled way lanes, shoulders, turn lanes, tapers, ramps, acceleration lanes, and deceleration lanes measured transverse to the mainline. The 10 ft (3 m) straightedge will also be utilized for acceptance of smoothness of all dense graded courses measured longitudinally for public road approaches and median crossovers.

~~The 10 ft (3 m) long straightedge shall be used to check transverse slopes, across travel lanes and shoulders, approaches, and crossovers.~~

(c) Smoothness Correction

~~All wavelike irregularities and abrupt changes in profile caused by paving operations shall be corrected.~~

~~Each finished course of base and intermediate shall be subject to approval. The pavement smoothness shall be checked on any new intermediate course located immediately below a surface course and the surface course at the locations as designated in ITM 912.~~

At locations where the profilograph is being used on an intermediate course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. After corrective action is taken on an intermediate course, a 16 ft (4.9 m) straightedge may be used to verify the adequacy of the corrective action.

At locations where the profilograph is being used on a surface course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. All

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS (CONTINUED)

smoothness sections with a deficient profile index in accordance with 401.19(d) shall be corrected. Underlying courses that are exposed by corrective action shall be milled to a depth of 1 1/2 in (38 mm) and replaced with surface course. After the corrective action is taken on a surface course, the profilograph shall be operated throughout the entire affected smoothness section to verify the adequacy of the corrective action.

At locations where the 16 ft (4.9 m) straightedge is used, the pavement variations shall be corrected to 1/4 in. (6 mm) or less. When the 10 ft (3 m) straightedge is used, the pavement variations shall be corrected to 1/8 in. (3 mm) or less.

If grinding of ~~the~~ *an* intermediate course is used for pavement smoothness corrections, the grinding shall not precede the surface placement by more than 30 calendar days if open to traffic.

~~When the 16 ft (4.9 m) straightedge is used on a surface course, the pavement variations shall be corrected to 1/4 in. (6 mm) or less. When the 10 ft (3 m) straightedge is used, the pavement variations shall be corrected to 1/8 in. (3 mm) or less.~~

~~When the profilograph is being used on a surface course, in addition to the requirements for the profile index, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. Courses underlying the surface courses that are exposed by corrective actions shall be milled to 1 1/2 in (38 mm) and replaced with the same type surface materials. The initial profile index shall be determined prior to any corrective action. The final profile index for each section requiring corrective action will be determined after all corrective action within that section has been completed.~~

~~When the profilograph is being used on an intermediate course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. After corrective action is taken on an intermediate course, a 16 ft (4.9 m) straightedge may be used to verify the adequacy of the corrective action. When the 16 ft (4.9 mm) or 10 ft (3 m) straightedge is being used on an intermediate course, all areas having a high or low point deviation in excess of 1/4 in. (6 mm) shall be corrected.~~

SECTION 401, BEGIN LINE 578, DELETE AND INSERT AS FOLLOWS:

(c) Smoothness

~~When the pavement smoothness is tested with a profilograph, payment will be based on a zero blanking band on the final profile index in accordance with the following table. A Quality Assurance Pay Factor, PFs, for smoothness will apply to the planned typical section including the aggregate base, and the HMA base, intermediate, and surface courses. The quality assurance adjustment for each section will include the total area of each pavement lane excluding shoulders for 0.1 mi (0.16 km) long section represented by the profile index calculated by the following formula.~~

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS (CONTINUED)

Smoothness pay adjustments will only be applied when the smoothness is measured by a profilograph. The pay adjustment will be based on the profile index generated on the surface course only.

At locations where a profilograph is used to accept smoothness, a quality assurance adjustment will be determined for each 0.1 mi (0.16 km) section of each lane. This adjustment will be applied to all QC/QA HMA pay items within the pavement section. The adjustment for each section will be calculated using the following formula.

$$q_s = (PF_s - 1.00) \sum_{i=1}^{n} \left(A \times \frac{S}{T} \times U \right)$$

where:

q_s = quality assurance adjustment for smoothness for one section
PF_s = pay factor for smoothness
n = number of layers
A = area of the section, syd (m^2)
S = planned spread rate for material, lb/syd (kg/m^2)
T = conversion factor: 2000 lb/ton (1000 kg/Mg)
U = unit price for the material, $/ton ($/Mg)

For smoothness sections that are less than 0.1 mi (0.16 km) in length or require profilograph operation along both lane edges, the profile index used to obtain the smoothness pay factor used in the above formula will be determined in accordance with ITM 912.

The quality assurance adjustment for smoothness, Qs, for the contract will be the total of the quality assurance adjustments for smoothness, qs, on each section by the following formula.

$$Q_s = \sum q_s$$

When smoothness is measured by a profilograph, payment adjustments will be made based on a zero blanking band on the final profile index in accordance with the following table. Regardless of the tabulated value below, the maximum pay factor for a smoothness section where corrective action has been performed will be 1.00.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS (CONTINUED)

PAY FACTOR ~~ADJUSTMENT~~ FOR SMOOTHNESS ($PI_{0.0}$) ZERO BLANKING BAND	
Design Speed Greater Than 45 mph (70 km/hr)	
Profile Index in./0.1 mi. (mm per 0.16 km)	Pay Factor, PF_s
Over 0.00 to 1.20 in. (Over 0 to 30 mm)	1.06
Over 1.20 to 1.40 in. (Over 30 to 35 mm)	1.05
Over 1.40 to 1.60 in. (Over 35 to 40 mm)	1.04
Over 1.60 to 1.80 in. (Over 40 to 45 mm)	1.03
Over 1.80 to 2.00 in. (Over 45 to 50 mm)	1.02
Over 2.00 to 2.40 in. (Over 50 to 60 mm)	1.01
Over 2.40 to 3.20 in. (Over 60 to 80 mm)	1.00
Over 3.20 to 3.40 in. (Over 80 to 85 mm)	0.96
All pavement with a profile index ($PI_{0.0}$) greater than 3.40 in. (85 mm) shall be corrected to *a profile index less than or equal to* 3.40 in. (85 mm).	

~~Quality assurance pay factors greater than 1.00 will be applicable only to the initial measured profile index, prior to any corrective work. Regardless of the pay factor tabulated above, quality assurance pay factors for individual sections that require corrective action for high or low points in excess of 0.3 in. (8 mm) will not be greater than 1.00. Quality assurance pay factors of 1.00 or less will be applied to pavement sections where corrective work has been completed.~~

The total quality assurance adjustment~~s~~ is ~~to be~~ calculated as follows:

$$Q = Q_s + (\sum q)$$

where:

Q = total quality assurance adjustment
Q_s = quality assurance adjustment for smoothness
q = lot or sublot quality assurance adjustment

COMMENTS AND ACTION

REVISION TO SECTION 401.18 PAVEMENT SMOOTHNESS
REVISION TO SECTION 401.19 PAY FACTORS

Motion:
Second:
Ayes:
Nays:

Standard Specifications Sections affected:
109.05.1 p108;
402.18 p258;
410.18 p283;
410.19 p284.

Recurring Special Provision affected:

400-C-553;
411-R-432.

Standard Sheets affected:
None

GIFE Sections affected:

Section 13

Action:
_____ Passed as Submitted
_____ Passed as Revised
_____ Withdrawn

_____ 20__ Standard Specifications Book

_____ Create RSP (No._____)
Effective _____Letting
RSP Sunset Date: _____

_____ Revise RSP (No._____)
Effective _____Letting
RSP Sunset Date: _____

Standard Drawing Effective _____
_____ Create RPD (No. _____)
Effective _____Letting
_____ Technical Advisory

GIFE Update Req'd.? Y ___ N ___
By _____ Addition or _____ Revision

Frequency Manual Update Req'd? Y___N___
By _____ Addition or _____ Revision

Received FHWA Approval? _____

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Revisions to smoothness measurement requirements have been proposed to Section 401 for HMA pavements in order to enable the Department to determine which contracts will require the profilograph and which ones will utilize a 16 ft straightedge to verify longitudinal pavement smoothness. In order to maintain consistent requirements for all pavement types, similar revisions are proposed to 501.

PROPOSED SOLUTION: Attached revised specifications. If passed by the Standards Committee, these proposed changes can be incorporated into RSP 501-R-540. In addition, if passed by the Standards Committee, proposed revisions to ITM 912 will be forwarded to the ITM Committee for consideration.

APPLICABLE STANDARD SPECIFICATIONS: 501.25, 501.28 (d)

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: Chapter 52

APPLICABLE SECTION OF GIFE: Section 8

APPLICABLE RECURRING SPECIAL PROVISIONS: 501-R-540

Submitted By: Ron Heustis/Jeff James

Title: Field Engineer

Organization: INDOT

Phone Number: 317/232-5082

Date: October 21, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? None. INDOT Division of Construction Management and District Construction personnel have reviewed these proposed revisions as well as the companion revisions to 401 for HMA pavements.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO THE SECTION 501.25 PAVEMENT SMOOTHNESS
REVISION TO THE SECTION 501.28 PAY FACTORS (CONTINUED)

The Standard Specifications are revised as follows:

SECTION 501, BEGIN LINE 368, DELETE AND INSERT AS FOLLOWS:

501.25 Pavement Smoothness

~~The p~~*P*avement smoothness will be accepted by means of a profilograph, a 16 ft (4.9 m) long straightedge, or a 10 ft (3 m) long straightedge *as described below*.

(a) Profilograph

When a pay item for Profilograph, PCCP is included in the contract, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 912 for the acceptance of longitudinal smoothness on the mainline traveled way and ramps, including adjacent acceleration or deceleration lane, where both of the following conditions are met:

~~The profilograph shall be used where all of the following conditions are met:~~

~~(a)~~*1)* ~~t~~*T*he design speed is greater than 45 mph (70 km/h)~~, and~~.

~~(b)~~*2)* ~~t~~*T*he ~~pavement~~ *traveled way or ramp* lane~~s~~ *width* ~~excluding shoulders are~~ *is* ~~full~~ *constant* ~~width~~ and *is* 0.1 mi (0.16 km) *in length* or longer.

~~If a pay item, profilograph, PCCP, is included in the contract, and the above conditions are met, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 912.~~ The profilogram produced shall become the property of the Department. The profilograph shall remain the property of the Contractor. ~~When a profilograph, PCCP is not included as a pay item, and the above conditions are met, the Department will furnish, calibrate, and operate the profilograph or the Department will develop a change order in accordance with 109.05 to include profilograph, PCCP as a pay item.~~

The project area, less paving exceptions and areas exempt from profilograph operation in accordance with ITM 912, will be divided into individual smoothness sections measuring 0.1 mi (0.16 km) in length for each lane. Partial length smoothness sections adjacent to project limits, paving exceptions, or areas exempt from profilograph operation will be considered in accordance with ITM 912.

If the posted speed limit for an entire smoothness section is less than or equal to 45 mph, the section will be exempt from profilograph operation and the smoothness within the section will be accepted by a 16 ft (4.9 m) straightedge.

If the posted speed limit is greater than 45 mph for a portion of a smoothness section and is less than or equal to 45 mph for the remainder, the section smoothness acceptance will be as follows:

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO THE SECTION 501.25 PAVEMENT SMOOTHNESS
REVISION TO THE SECTION 501.28 PAY FACTORS (CONTINUED)

1) By profilograph for the portion of the section with a posted speed limit greater than 45 mph.

2) By profilograph or 16 ft (4.9 m) straightedge for the portion of the section with a posted speed limit less than or equal to 45 mph at the Contractor's option. The Contractor shall notify the Engineer of the selected option prior to beginning the paving operation in the smoothness section.

At locations where the profilograph is required, all high or low point deviations which are greater than 0.3 in (8 mm) shall be corrected. Corrections shall be made in accordance with 501.25(c).

(b) 16 ft (4.9 m) Straightedge and 10 ft (3 m) Straightedge

The Department will furnish and operate 16 ft (4.9 m) and 10 ft (3 m) straightedges as described below. The 16 ft (4.9 m) straightedge is used to accept smoothness along the direction of mainline traffic and the 10 ft (3.0 m) straightedge is used to accept smoothness transverse to the direction of mainline traffic. This includes longitudinal smoothness on public road approaches and median crossovers. The Contractor shall provide all traffic control required for the operation of straightedges.

~~The 16 ft (4.9 m) long straightedge shall be used on all full-width pavement lanes shorter than 0.1 mi (0.16 km), on tapers, within 50 ft (15 m) of a reinforced concrete bridge approach, and within 50 ft (15 m) of an existing pavement which is being joined, and shoulders greater than 10 ft (3 m) wide.~~

For contracts which include the profilograph, PCCP pay item, the 16 ft (4.9 m) long straightedge will be used to accept longitudinal smoothness at the following locations:

1) All mainline traveled way lanes shorter than 0.1 mi (0.16 km).
2) All mainline traveled way lanes within smoothness sections with posted speed limits less than or equal to 45 mph throughout the entire section length.
3) All mainline traveled way lanes at locations exempted from profilograph operation in accordance with ITM 912.
4) All tapers.
5) All turn lanes, including bi-directional left turn lanes.
6) All ramps with design speeds of 45 mph (70 km/h) or less.
7) All acceleration and deceleration lanes associated with ramps with design speeds of 45 mph (70 km/h) or less.
8) All shoulders.

For contracts where the profilograph is not used for smoothness acceptance, the 16 ft (4.9 m) straightedge will be used to accept longitudinal smoothness at the above locations and on all mainline traveled way lanes and ramps with design speeds greater

than 45 mph (70 km/h). Smoothness acceptance on ramp acceleration or deceleration lanes will also be accepted by the 16 ft (4.9 m) straightedge.

~~The 10 ft (3 m) long straightedge shall be used for transverse slopes, approaches, and crossovers.~~

For all contracts, a 10 ft (3 m) straightedge will be used for smoothness acceptance for all traveled way lanes, shoulders, turn lanes, tapers, ramps, acceleration lanes, and deceleration lanes measured transverse to the mainline. The 10 ft (3 m) straightedge will also be utilized for acceptance of smoothness of all dense graded courses measured longitudinally for public road approaches and median crossovers.

As soon as the PCCP has cured sufficiently, the smoothness may be checked. Profile testing shall be completed prior to opening the pavement to traffic. The Department may direct that the pavement profile be evaluated within 24 h following placement. When profile testing is consistently outside pavement surface tolerances the paving operation shall be discontinued until an amended QCP is submitted. ~~An initial profile index will be determined from the profilogram of this profile. The initial profile index for areas requiring replacement will be adjusted to include the results of a profilogram of all replaced areas.~~

(c) Smoothness Correction

Pavement smoothness variations outside specified tolerances shall be corrected by grinding with a groove type cutter or by replacement. Grinding will not be permitted until the PCCP is 10 days old or the flexural strength test is 550 psi (3800 kPa) or greater. The grinding of the pavement to correct the profile shall be accomplished in either the longitudinal or the transverse direction. The PCCP texture after grinding shall be uniform. If the grinding operation reduces the tining grooves to a depth of less than 1/16 in. (1.5 mm) and the longitudinal length of the removal area exceeds 15 ft (4.5 m), or two or more areas are within 30 ft (9.0 m) of each other, the PCCP shall be re-textured in accordance with 504.03.

At locations where the profilograph is used, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. In addition, smoothness sections with a deficient profile index in accordance with 501.28(d) shall be corrected. After the corrective action is complete, the profilograph shall be operated throughout the entire affected smoothness section to verify the adequacy of the corrective action.

~~When~~ *At locations where* the 16 ft (4.9 m) straightedge is used, the pavement variations shall be corrected to 1/4 in. (6 mm) or less. ~~When~~ *At locations where* the 10 ft (3 m) straightedge is used, the pavement variations shall be corrected to 1/8 in. (3 mm) or less.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO THE SECTION 501.25 PAVEMENT SMOOTHNESS
REVISION TO THE SECTION 501.28 PAY FACTORS (CONTINUED)

~~When the profilograph is used, the pavement variations shall be corrected in accordance with 501.28(d). In addition to the requirements for the profile index, all areas having a high or low points deviation in excess of 0.3 in. (8 mm) shall be corrected. Verifying profilograph measurements will be taken only in the 0.1 mi (0.16 km) length where corrections have been performed.~~

SECTION 501, BEGIN LINE 562, DELETE AND INSERT AS FOLLOWS:

(d) Smoothness

When the pavement smoothness is tested with a profilograph, pavement will be based on a zero blanking band on the final profile index~~ after corrective action~~. A Quality Assurance Pay Factor (PFs) for smoothness will apply to the planned thickness of the PCCP. The quality assurance adjustment for each section will include the total area of each pavement lane ~~excluding shoulders~~ *measured by the profilograph* for 0.1 mi (0.16 km) long section represented by the profile index calculated by the following formula:

$$q_s = (PF_s - 1.00) \times A \times U$$

where:

q_s = quality assurance adjustment for smoothness for one section
PFs = pay factor for smoothness
A = area of the section, SYS (m2)
U = unit price for the material $/SYS ($/m2)

For smoothness sections that are less than 0.1 mi (0.16 km) in length or require profilograph operation along both lane edges, the profile index used to obtain the smoothness pay factor used in the above formula will be determined in accordance with ITM 912.

The quality assurance adjustment for smoothness, Qs, for the contract will be the total of the quality assurance adjustments for smoothness, qs, on each section by the following formula:

$$Q_s = \Sigma\, q_s$$

Regardless of the below tabulated value, the maximum pay factor for a smoothness section where corrective action has been performed will be 1.00.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO THE SECTION 501.25 PAVEMENT SMOOTHNESS
REVISION TO THE SECTION 501.28 PAY FACTORS (CONTINUED)

SECTION PAY FACTORS FOR SMOOTHNESS ($PI_{0.0}$) ZERO BLANKING BAND	
Design Speed Greater Than 45 mph (70 km/hr)	
Profile Index in./0.1 mi. (mm/0.16 km)	Pay Factor, PF_s
Over 0.00 to 1.40 in. (Over 0 to 35 mm)	1.06
Over 1.40 to 1.60 in. (Over 35 to 40 mm)	1.05
Over 1.60 to 1.80 in. (Over 40 to 45 mm)	1.04
Over 1.80 to 2.00 in. (Over 45 to 50 mm)	1.03
Over 2.00 to 2.40 in. (Over 50 to 60 mm)	1.02
Over 2.40 to 2.80 in. (Over 60 to 70 mm)	1.01
Over 2.80 to 3.60 in. (Over 70 to 90 mm)	1.00
Over 3.60 to 3.80 in. (Over 90 to 95 mm)	0.96
All pavements with a Profile Index ($PI_{0.0}$) greater than 3.80 in. (95 mm) shall be corrected to *a profile index less than or equal to* 3.80 in. (95mm).	

COMMENTS AND ACTION

REVISION TO THE SECTION 501.25 PAVEMENT SMOOTHNESS
REVISION TO THE SECTION 501.28 PAY FACTORS

Motion:
Second:
Ayes:
Nays:

Standard Specifications Sections affected:

109.05.1 p108; 501.26 p297; 501.27 p298; 501.28 p299; 502.20 p314; 507.06 p339

Recurring Special Provision affected:

501-R-540

Standard Sheets affected:

None

GIFE Sections affected:

Section 8

Action:
_____ Passed as Submitted
_____ Passed as Revised
_____ Withdrawn

_____ 20__ Standard Specifications Book

_____ Create RSP (No._____)
Effective _____Letting
RSP Sunset Date: _____

_____ Revise RSP (No._____)
Effective _____Letting
RSP Sunset Date: _____

Standard Drawing Effective _____
_____ Create RPD (No. _____)
Effective _____Letting
_____ Technical Advisory

GIFE Update Req'd.? Y ___ N ___
By _____ Addition or _____ Revision

Frequency Manual Update Req'd? Y___N___
By _____ Addition or _____ Revision

Received FHWA Approval? _____

Ms. Rearick
Date: 12/17/09

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: There are sizes of backfill materials for use in MSE wall volumes that are allowed by AASHTO but not presently allowed by INDOT specifications. By not allowing some of these backfill material sizes, we may be unnecessarily increasing the cost of our contracts that contain MSE walls.

PROPOSED SOLUTION: Add No. 5 and No. 12 size coarse aggregate and 1 in. and 1/2 in. size structure backfill to the allowable size options for MSE wall volume backfill. This brings the number of available sizes to 8.

Due to concerns about permeability and that No. 30 structure backfill is not allowed by AASHTO, No. 30 size structure backfill is proposed to be deleted from the list of allowable Type 3 structure backfill sizes.

APPLICABLE STANDARD SPECIFICATIONS: 211.03.1 & 904.05

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE:tbd

APPLICABLE RECURRING SPECIAL PROVISIONS:create new RSP

Submitted By: Anne Rearick

Title: Manager, Office of Structural Services

Organization: INDOT

Phone Number: 232-5152

Date: November 4, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? INDOT Retaining Wall Committee.

Item No. 01 12/17/09 (2010 SS)
Ms. Rearick
Date: 12/17/09

REVISION TO THE STANDARD SPECIFICATIONS

731-X-XXX STRUCTURE BACKFILL FOR MSE WALL
(PROPOSED RECURRING SPECIAL PROVISION)

731-x-xxx STRUCTURE BACKFILL FOR MSE WALL

(Adopted xx/xx/xx)

The Standard Specifications are revised as follows:

SECTION 211, BEGIN LINE 112, DELETE AND INSERT AS FOLLOWS:

(c) Type 3

1. structure backfill in accordance with 904.05, except only ~~No. 30~~ *1 in., 1/2 in.,* or No. 4 nominal size aggregates, or *No. 5,* No. 8, No. 9, ~~or~~ No. 11*, or No. 12* coarse aggregate shall be used. No slag other than ACBF will be permitted.

SECTION 904, BEGIN LINE 320, DELETE AND INSERT AS FOLLOWS:

904.05 Structure Backfill

The material shall be of acceptable quality, free from large or frozen lumps, wood, or other extraneous matter. It shall consist of suitable sand, gravel, crushed stone, ACBF, or GBF. Structure backfill shall be in accordance with one of the ~~following~~ gradations *shown in the table below,* or *No. 5,* No. 8, No. 9, No. 11, *No. 12,* No. 53, or No. 73 coarse aggregate in accordance with the gradation requirements of 904.03(e). Coarse aggregate *No. 5,* No. 8, No. 9, No. 11, *No. 12,* No. 53, or No. 73 shall be crushed stone or ACBF, class D or higher.

Item No. 01 12/17/09 (2010 SS)
Ms. Rearick
Date: 12/17/09

COMMENTS AND ACTION

731-X-XXX STRUCTURE BACKFILL FOR MSE WALL
(PROPOSED RECURRING SPECIAL PROVISION)

Motion: Second: Ayes: Nays:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections affected: 212.01 p.198; 211.03.1 p.195	_____ 20__ Standard Specifications Book _____ Create RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Recurring Special Provisions affected: 203-R-360; 717-R-152; 731-R-202; 732-R-310; 732-R-433; 734-R-566.	_____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____ Standard Drawing Effective _____ _____ Create RPD (No. _____) Effective _____Letting _____ Technical Advisory
Standard Sheets affected: None	GIFE Update Req'd.? Y ___ N ___ By _____ Addition or _____ Revision
GIFE Sections affected: None	Frequency Manual Update Req'd? Y___N___ By _____ Addition or _____ Revision Received FHWA Approval? _____

Mr. Wright
Date: 12/17/09

SPECIFICATION REVISIONS

REVISION TO THE STANDARD DRAWINGS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Change the safety cable, stiffened box truss up for transportation and installation purposes, incorporated lighting walkway Standards to box truss structure Standards and added new drilled foundations for the box truss structures.

PROPOSED SOLUTION: The safety cable was changed to a guard railing according with OSHA guidelines. Corner bracing was added to external corners of Exterior and Interior Sections of the box truss and some members of the truss were increased in diameter. The Lighting Walkways Standards for trusses were included with new name and some updated. New drilled foundations were added. Issue a Design Memorandum to provided guidance to designers. Standard Drawings E802-SNWW-01 to 06 needs to be deleted.

APPLICABLE STANDARD SPECIFICATIONS: 802, 910

APPLICABLE STANDARD DRAWINGS: E802-SBTS-01 to 19 and E802-BTSF-01 to 08

APPLICABLE DESIGN MANUAL SECTION: n/a

APPLICABLE SECTION OF GIFE:n/a

Submitted By: John Wright / Alfredo Hanza

Title: Road Services Manager

Organization: INDOT

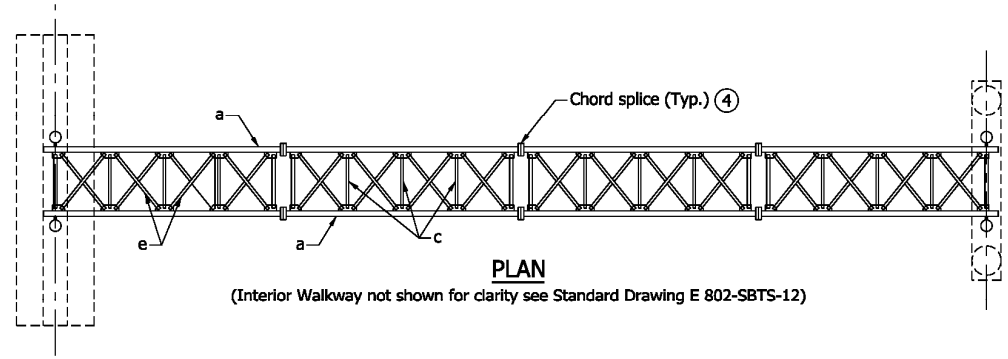
Phone Number: 232-5147 / 232-5236

Date: 11/9/09

Item No. 02 12/17/09 (2010 SS)
Mr. Wright
Date: 12/17/09

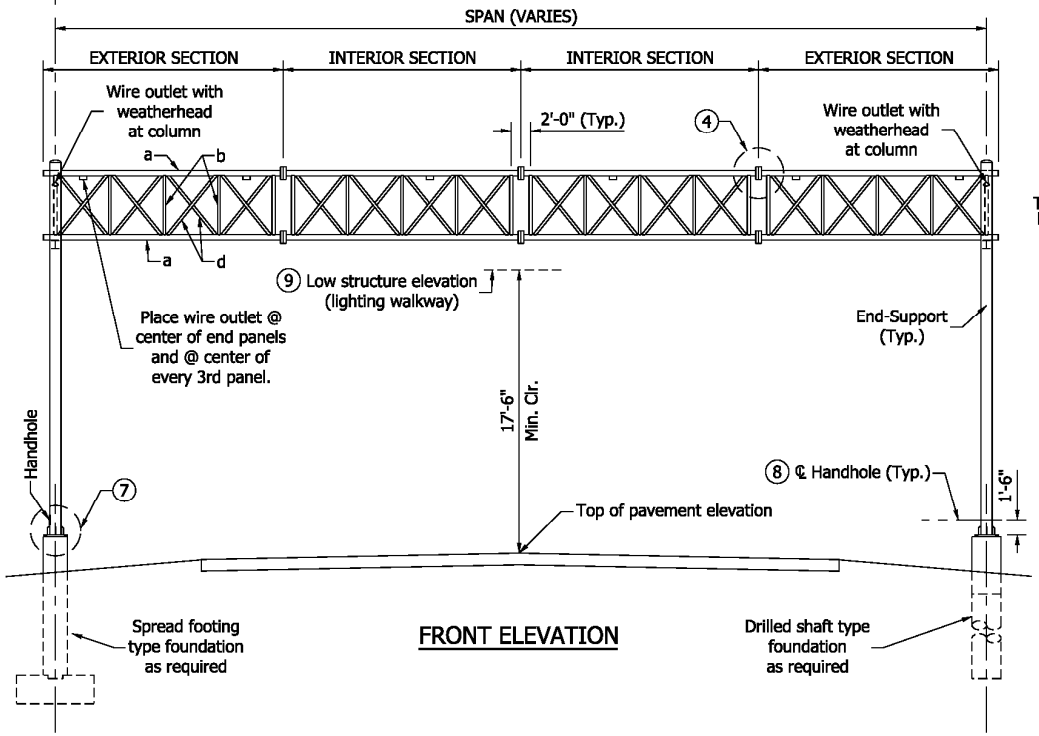
REVISION TO THE STANDARD DRAWINGS

802-SBTS-01 SIGN BOX TRUSS STRUCTURE GENERAL PLAN & ELEVATION (PROPOSED NEW DRAWING)

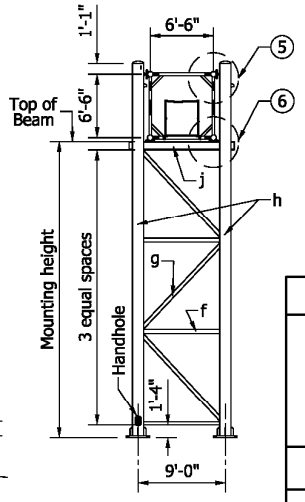


PLAN

(Interior Walkway not shown for clarity see Standard Drawing E 802-SBTS-12)



FRONT ELEVATION



END-SUPPORT

NOTES:

1. See Standard Drawings E 802-SBTS-02 for member sizes.
2. Maximum deviation of any chord from a straight line in any section shall be 1/8" Box truss to be maximum of 3/8" out of a straight line over the entire length of the structure in the vertical plane.
3. All box truss members are aluminum, End-support members are steel. Walkways, bearing elements, and wire outlet are aluminum.

(4) See Standard Drawing E 802-SBTS-06 for connection flange details.

(5) See Standard Drawing E 802-SBTS-07 for upper chord connection details.

(6) See Standard Drawings E 802-SBTS-08/08A for lower chord connection details.

(7) See Standard Drawings E 802-SBTS-09 for base plate detail and E 802-SBTS-11 for anchor bolts and skirt details.

(8) See Standard Drawing E 802-SBTS-10 for handhole detail.

(9) If box truss signing does not require lighting walkway, the clearance shall be 19' to the bottom of the sign. Sign shall be centered on box truss.

LEGEND

TRUSS MEMBERS
- a - Chords
- b - Verticals
- c - Horizontals
- d - Vertical Diagonals
- e - Horizontal Diagonals

END-SUPPORT MEMBERS
- h - Columns
- f - Horizontals
- g - Diagonals
- j - Horizontal W-Beam or HSS Beam

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
GENERAL PLAN & ELEVATION

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-01

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

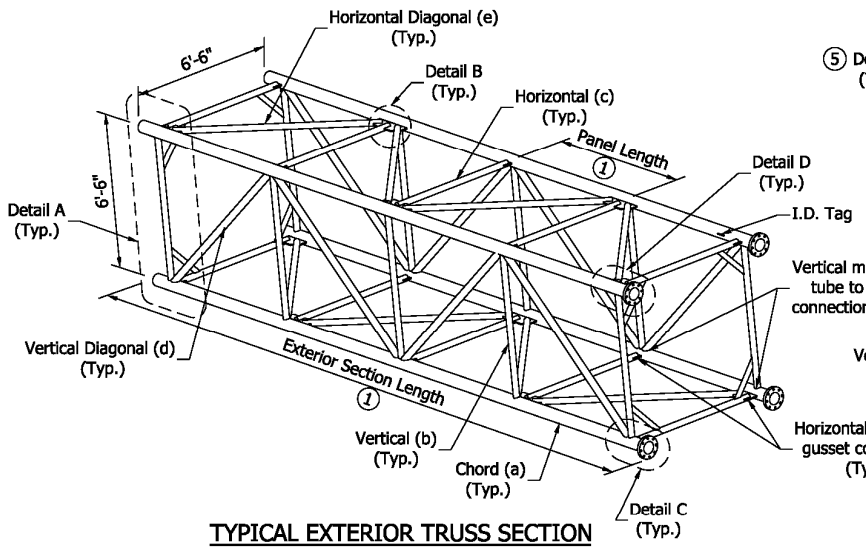
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

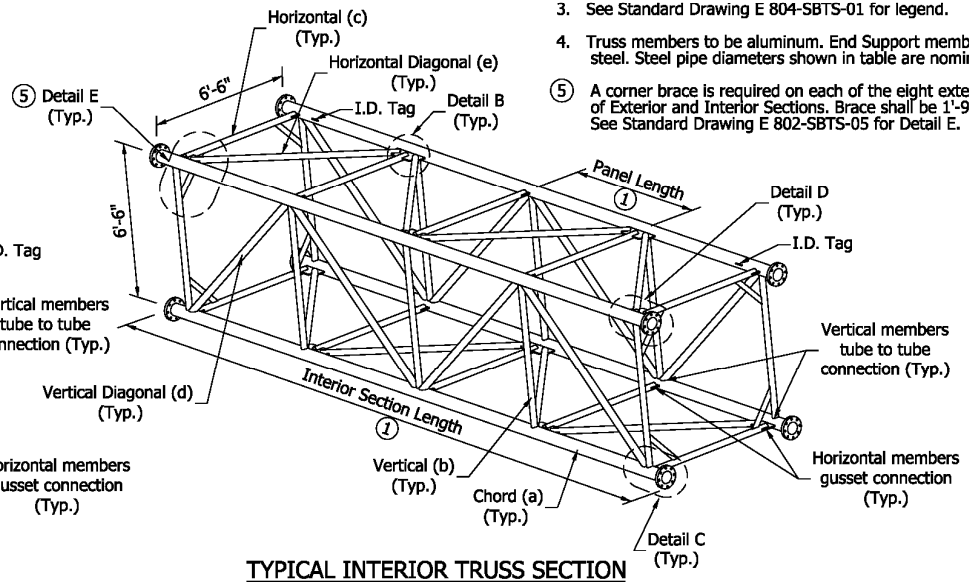
802-SBTS-02 SIGN BOX TRUSS STRUCTURE TRUSS SECTIONS IN ISOMETRIC VIEWS TABLE WITH MEMBER SIZES (PROPOSED NEW DRAWING)

Notes:

1. Number of panels and sections varies, see table on Standard Drawing E 802-SBTS-03 and 04 for Recommended dimensions.
2. See Standard Drawing E 802-SBTS-05 for welded connections and Details A thru F.
3. See Standard Drawing E 804-SBTS-01 for legend.
4. Truss members to be aluminum. End Support members to be steel. Steel pipe diameters shown in table are nominal pipe size.
5. A corner brace is required on each of the eight external corners of Exterior and Interior Sections. Brace shall be 1'-9"x3"x1/2". See Standard Drawing E 802-SBTS-05 for Detail E.



TYPICAL EXTERIOR TRUSS SECTION



TYPICAL INTERIOR TRUSS SECTION

TRUSS TYPE	MAX. SIGN AREA	MAX. SPAN	MAX. MOUNTING HEIGHT	TRUSS MEMBERS SIZES										END SUPPORT MEMBERS SIZES						
				CHORD		VERTICAL		HORIZONTAL		VERTICAL DIAGONAL		HORIZONTAL DIAGONAL		HORIZONTAL		DIAGONAL		COLUMN		SUPPORTING BEAM
			H	a		b		c		d		e		f		g		h		j
				DIA.	THK	DIA.	THK	DIA.	THK	DIA.	THK	DIA.	THK	DIA.	THK	DIA.	THK	DIA.	THK	
	SQ. FT.	FT.	FT.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	
A	500	130	28'-6"	6.00	0.250	2.50	0.250	4.00	0.188	3.00	0.375	4.00	0.375	5.00	0.375	5.00	0.375	14.00	0.500	W 8 x 58 or HSS 8"x8"x1/2"
B	700	100	28'-6"	6.50	0.375	3.00	0.375	4.00	0.188	3.00	0.500	4.00	0.375	5.00	0.375	7.00	0.375	14.00	0.500	
C		130	28'-6"	7.00	0.375	3.00	0.375	4.00	0.188	3.00	0.500	4.00	0.500	5.00	0.375	8.00	0.500	14.00	0.593	
D	900	100	28'-6"	7.00	0.375	3.00	0.375	4.00	0.188	3.00	0.500	4.00	0.500	5.00	0.375	8.00	0.500	18.00	0.500	
E		130	28'-6"	7.00	0.500	3.00	0.375	4.00	0.250	3.00	0.500	4.00	0.500	5.00	0.375	8.00	0.593	18.00	0.593	W 10 x 68 or HSS 10"x10"x1/2"

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
TRUSS SECTIONS IN ISOMETRIC VIEWS
TABLE WITH MEMBER SIZES
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-02

DESIGN STANDARDS ENGINEER

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

REVISION TO THE STANDARD DRAWINGS

802-SBTS-03 SIGN BOX TRUSS STRUCTURE RECOMMENDED DIMENSIONS SPANS 34’ THRU 81’ (PROPOSED NEW DRAWING)

RECOMMENDED DIMENSIONS FOR SIGN BOX TRUSSES (34' thru 81')									
SPAN	EXTERIOR SECTIONS					INTERIOR SECTIONS			
SPAN-TRUSS LENGTH, (FT)	NO. OF EXT. SECTIONS	NO. OF PANELS PER SECTION	VARIABLE END DIMEN.	PANEL LENGTH	SECTION LENGTH	NO. OF INT. SECTIONS	NO. OF PANELS PER SECTION	PANEL LENGTH	SECTION LENGTH
34	1	6	6"	5'-6"	35'-6"	0			
35	1	6	6"	5'-8"	36'-6"	0			
36	2	3	6"	5'-6"	18'-9"	0			
37	2	3	6"	5'-8"	19'-3"	0			
38	2	3	6"	5'-10"	19'-9"	0			
39	2	3	6"	6'	20'-3"	0			
40	2	3	6"	6'-2"	20'-9"	0			
41	2	3	6"	6'-4"	21'-3"	0			
42	2	3	6"	6'-6"	21'-9"	0			
43	2	4	6"	5'	22'-3"	0			
44	2	4	6"	5'-1 1/2"	22'-9"	0			
45	2	4	6"	5'-3"	23'-3"	0			
46	2	4	6"	5'-4 1/2"	23'-9"	0			
47	2	4	6"	5'-6"	24'-3"	0			
48	2	4	6"	5'-7 1/2"	24'-9"	0			
49	2	4	6"	5'-9"	25'-3"	0			
50	2	4	6"	5'-10 1/2"	25'-9"	0			
51	2	4	6"	6'	26'-3"	0			
52	2	4	6"	6'-1 1/2"	26'-9"	0			
53	2	4	6"	6'-3"	27'-3"	0			
54	2	4	6"	6'-4 1/2"	27'-9"	0			
55	2	4	6"	6'-6"	28'-3"	0			
56	2	5	5 1/4"	5'-3 3/4"	28'-9"	0			
57	2	5	6 1/4"	5'-4 3/4"	29'-3"	0			
58	2	5	6"	5'-6"	29'-9"	0			
59	2	5	5 3/4"	5'-7 1/4"	30'-3"	0			
60	2	5	5 1/2"	5'- 8 1/2"	30'-9"	0			
61	2	5	6 1/2"	5'-9 1/2"	31'-3"	0			
62	2	5	6 1/4"	5'-10 3/4"	31'-9"	0			
63	2	5	6"	6'	32'-3"	0			
64	2	5	5 3/4"	6'-1 1/4"	32'-9"	0			
65	2	5	5 1/2"	6'-2 1/2"	33'-3"	0			
66	2	5	5 1/4"	6'-3 3/4"	33'-9"	0			
67	2	5	6 1/4"	6'-4 3/4"	34'-3"	0			
68	2	5	6"	6'-6"	34'-9"	0			
69	2	4	6"	5'-4"	23'-7"	1	4	5'-4"	23'-4"
70	2	4	6"	5'-5"	23'-11"	1	4	5'-5"	23'-8"
71	2	4	6"	5'-6"	24'-3"	1	4	5'-6"	24'
72	2	4	6"	5'-7"	24'-7"	1	4	5'-7"	24'-4"
73	2	4	6"	5'-8"	24'-11"	1	4	5'-8"	24'-8"
74	2	4	6"	5"-9"	25'-3"	1	4	5"-9"	25'
75	2	4	6"	5'-10"	25'-7"	1	4	5'-10"	25'-4"
76	2	4	6"	5'-11"	25'-11"	1	4	5'-11"	25'-8"
77	2	4	6"	6'	26'-3"	1	4	6'	26'
78	2	4	6"	6'-1 "	26'-7"	1	4	6'-1 "	26'-4"
79	2	4	6"	6'-2"	26'-11"	1	4	6'-2"	26'-8"
80	2	4	6"	6'-3"	27'-3"	1	4	6'-3"	27'
81	2	4	6"	6'-4"	27'-7"	1	4	6'-4"	27'-4"

NOTES:

1. The table of Recommended dimensions for Sign Box Truss structure are divided and put on two Standard Drawings E 802-SBTS-03 and -04. The table shows Dimensions with all sections requirements accounted for.
2. All panels on a truss shall be the same length. The minimum panel length for all trusses is 5'-0" and the maximum is 6'-6".
3. A single interior section in a truss shall have an even number of panels to maintain the pattern of the vertical diagonals.
4. Use minimum number of sections for each box truss structure, keeping the maximum section length at 36'-6".
5. See Standard Drawing E 802-SBTS-04 for required camber to build Sign Box Truss structure.

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
RECOMMENDED DIMENSIONS
SPANS 34' thru 81'
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-03

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

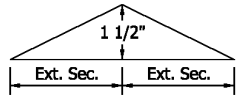
REVISION TO THE STANDARD DRAWINGS

802-SBTS-04 SIGN BOX TRUSS STRUCTURE RECOMMENDED DIMENSIONS SPANS 82’ THRU 130’ & CAMBER (PROPOSED NEW DRAWING)

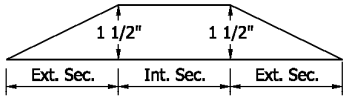
RECOMMENDED DIMENSIONS FOR SIGN BOX TRUSSES (82' thru 130')									
SPAN	EXTERIOR SECTIONS					INTERIOR SECTIONS			
SPAN-TRUSS LENGTH, (FT)	NO. OF EXT. SECTIONS	NO. OF PANELS PER SECTION	VARIABLE END DIMEN.	PANEL LENGTH	SECTION LENGTH	NO. OF INT. SECTIONS	NO. OF PANELS PER SECTION	PANEL LENGTH	SECTION LENGTH
82	2	4	6"	6'-5"	27'-11"	1	4	6'-5"	27'-8"
83	2	4	6"	6'-6"	28'-3"	1	4	6'-6"	28'
84	2	5	5 3/4"	5'-7 3/4"	30'-5 1/2"	1	4	5'-7 3/4"	24'-7"
85	2	5	6 1/2"	5'-8 1/2"	30'-10"	1	4	5'-8 1/2"	24'-10"
86	2	5	5 1/2"	5'-9 1/2"	31'-2"	1	4	5'-9 1/2"	25'-2"
87	2	5	6 1/4"	5'-10 1/4"	31'-6 1/2"	1	4	5'-10 1/4"	25'-5"
88	2	5	7"	5'-11"	31'-11"	1	4	5'-11"	25'-8"
89	2	5	6"	6'	32'-3"	1	4	6'	26'
90	2	5	6 3/4"	6'-3/4"	32'-7 1/2"	1	4	6'-3/4"	26'-3"
91	2	5	5 3/4"	6'-1 3/4"	32'-11 1/2"	1	4	6'-1 3/4"	26'-7"
92	2	5	6 1/2"	6'-2 1/2"	33'-4"	1	4	6'-2 1/2"	26'-10"
93	2	5	5 1/2"	6'-3 1/2"	33'-8"	1	4	6'-3 1/2"	27'-2"
94	2	5	6 1/4"	6'-4 1/4"	34'-1/2"	1	4	6'-4 1/4"	27'-5"
95	2	5	5 1/4"	6'-5 1/4"	34'-4 1/2"	1	4	6'-5 1/4"	27'-9"
96	2	5	6"	6'-6"	34'-9"	1	4	6'-6"	28'
97	2	4	6"	5'-7 1/2"	24'-9"	2	4	5'-7 1/2"	24'-6"
98	2	4	6"	5'-8 1/4"	25'	2	4	5'-8 1/4"	24'-9"
99	2	4	6"	5'-9"	25'-3"	2	4	5'-9"	25'
100	2	4	6"	5'-9 3/4"	25'-6"	2	4	5'-9 3/4"	25'-3"
101	2	4	6"	5'-10 1/2"	25'-9"	2	4	5'-10 1/2"	25'-6"
102	2	4	6"	5'-11 1/4"	26'	2	4	5'-11 1/4"	25'-9"
103	2	4	6"	6'	26'-3"	2	4	6'	26'
104	2	4	6"	6'-3/4"	26'-6"	2	4	6'-3/4"	26'-3"
105	2	4	6"	6'-1 1/2"	26'-9"	2	4	6'-1 1/2"	26'-6"
106	2	4	6"	6'-2 1/4"	27'	2	4	6'-2 1/4"	26'-9"
107	2	4	6"	6'-3"	27'-3"	2	4	6'-3"	27'
108	2	4	6"	6'-3 3/4"	27'-6"	2	4	6'-3 3/4"	27'-3"
109	2	4	6"	6'-4 1/2"	27'-9"	2	4	6'-4 1/2"	27'-6"
110	2	4	6"	6'-5 1/4"	28'	2	4	6'-5 1/4"	27'-9"
111	2	4	6"	6'-6"	28'-3"	2	4	6'-6"	28'
112	2	5	6"	5'-3"	28'-6"	2	5	5'-3"	28'-3"
113	2	5	7"	5'-3 1/2"	28'-9 1/2"	2	5	5'-3 1/2"	28'-5 1/2"
114	2	5	5 1/2"	5'-4 1/4"	28'-11 3/4"	2	5	5'-4 1/4"	28'-9 1/4"
115	2	5	6 1/2"	5'-4 3/4"	29'-3 1/4"	2	5	5'-4 3/4"	28'-11 3/4"
116	2	5	7 1/2"	5'-5 1/4"	29'-6 3/4"	2	5	5'-5 1/4"	29'-2 1/4"
117	2	5	6"	5'-6"	29'-9"	2	5	5'-6"	29'-6"
118	2	5	7"	5'-6 1/2"	30'-0 1/2"	2	5	5'-6 1/2"	29'-8 1/2"
119	2	5	5 1/2"	5'-7 1/4"	30'-2 3/4"	2	5	5'-7 1/4"	30'-1/4"
120	2	5	6 1/2"	5'-7 3/4"	30'-6 1/4"	2	5	5'-7 3/4"	30'-2 3/4"
121	2	5	7 1/2"	5'-8 1/4"	30'-9 3/4"	2	5	5'-8 1/4"	30'-5 1/4"
122	2	5	6"	5'-9"	31'	2	5	5'-9"	30'-9"
123	2	5	7"	5'-9 1/2"	31'-3 1/2"	2	5	5'-9 1/2"	30'-11 1/2"
124	2	5	5 1/2"	5'-10 1/4"	31'-5 3/4"	2	5	5'-10 1/4"	31'-3 1/4"
125	2	5	6 1/2"	5'-10 3/4"	31'-9 1/4"	2	5	5'-10 3/4"	31'-5 3/4"
126	2	5	7 1/2"	5'-11 1/4"	32' -0 3/4"	2	5	5'-11 1/4"	31'-8 1/4"
127	2	5	6"	6'	32'-3"	2	5	6'	32'
128	2	5	7"	6'-1/2"	32'-6 1/2"	2	5	6'-1/2"	32'-2 1/2"
129	2	5	5 1/2"	6'-1 1/4"	32'-8 3/4"	2	5	6'-1 1/4"	32'-6 1/4"
130	2	5	6 1/2"	6'-1 3/4"	33'-1/4"	2	5	6'-1 3/4"	32'-8 3/4"

NOTE:

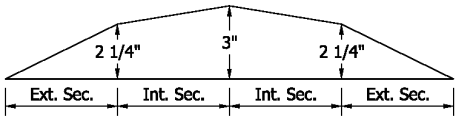
1. Camber diagrams to built truss structures with 2 to 4 sections are shown. Cambers shown are for fabrication only and are measured with trusses fully supported at no-load conditons. Allowable camber tolerance for truss is 25% of specific camber value.
2. See Standard Drawing E 805-SBTS-03 for other notes.



CAMBER DIAGRAM (2 Section Truss)



CAMBER DIAGRAM (3 Section Truss)



CAMBER DIAGRAM (4 Section Truss)

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
RECOMMENDED DIMENSIONS
SPANS 82' thru 130' & CAMBER
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-04

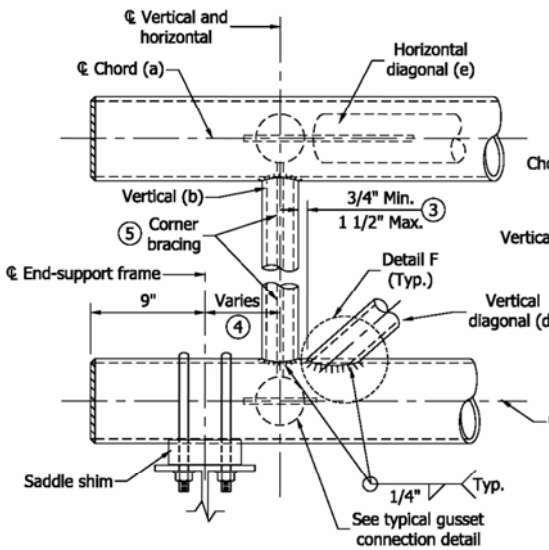
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

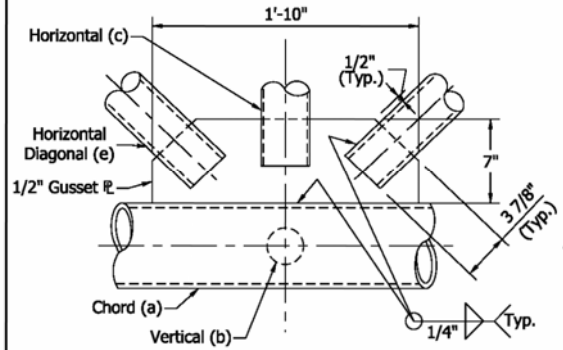
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

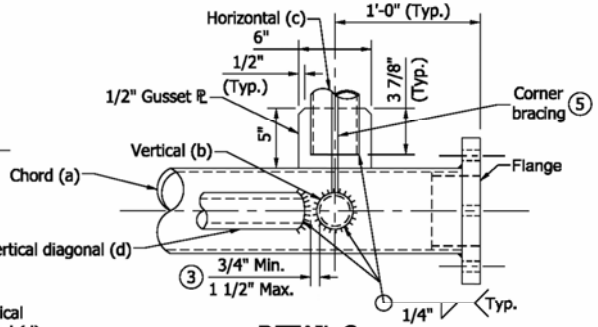
802-SBTS-05 SIGN BOX TRUSS STRUCTURE CHORD CONNECTIONS AND WELD DETAILS (PROPOSED NEW DRAWING)



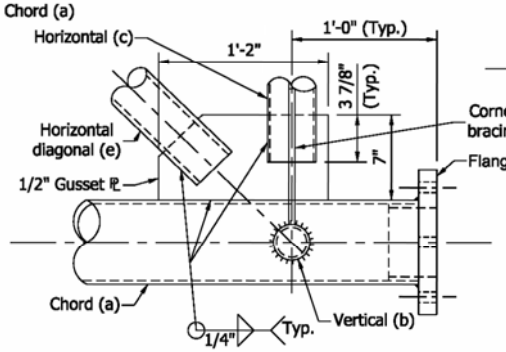
DETAIL A
EXTERIOR SECTION AT END SUPPORT



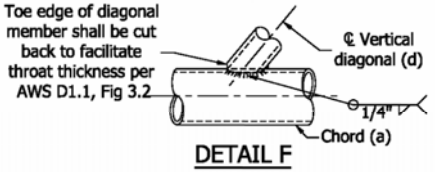
DETAIL B
TYPICAL PANEL CONNECTION
PLAN VIEW



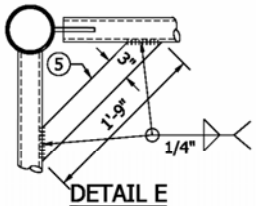
DETAIL C
CHORD AT FLANGE CONNECTION
PLAN VIEW



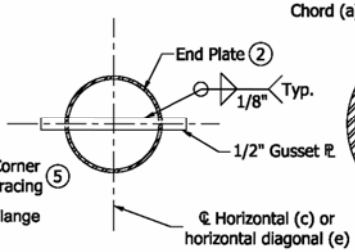
DETAIL D
CHORD AT FLANGE CONNECTION
PLAN VIEW



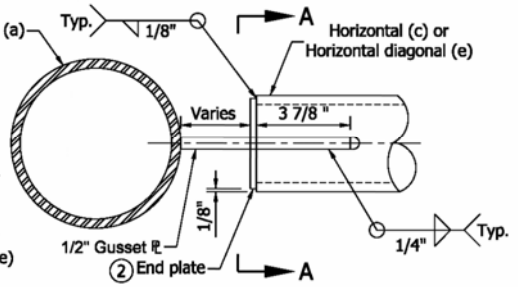
DETAIL F



DETAIL E
TYPICAL CORNER BRACING



SECTION A-A



TYPICAL GUSSET PLATE CONNECTION DETAIL
ELEVATION VIEW

NOTES:

1. All bracing members shall be machined to provide a snug fit to the chord along the entire edge of bracing members before welding. See Standard Drawing E 802-SBTS-02 for member location.
2. End plate may be welded as one piece and slotted or welded as two pieces after slotting the member.
3. Vertical and horizontal diagonals shall be detailed for minimum offset from the panel point based on the following: offset shall be such as to provide a 3/4" minimum to 1 1/2" maximum clearance between any diagonal and any horizontal or vertical member.
4. For Variable end dimension see table of recommended dimensions on Standard Drawing E 802-SBTS-03 & 04.
5. See Standard Drawing E 802-SBTS-02 for corner bracing locations.

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
CHORD CONNECTIONS AND WELD DETAILS

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-05

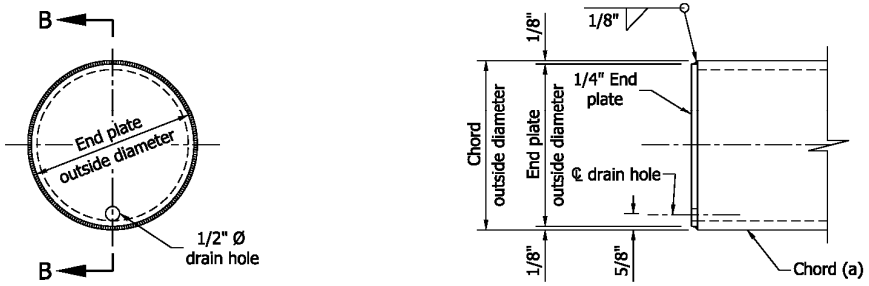
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-06 SIGN BOX TRUSS STRUCTURE FLANGE, CHORD END PLATE, AND WIRE OUTLET DETAILS (PROPOSED NEW DRAWING)

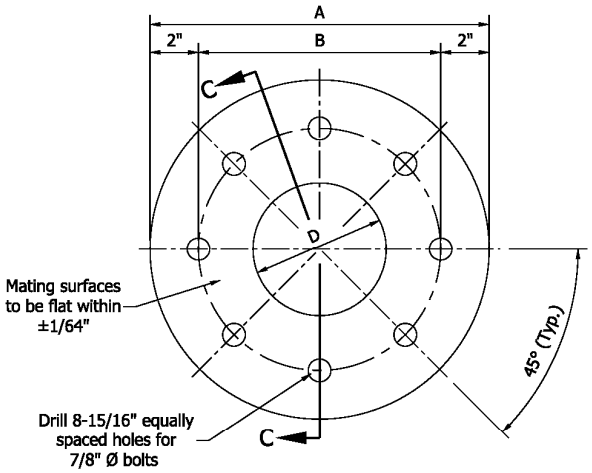


END VIEW

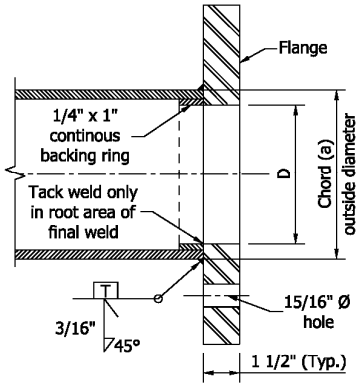
CHORD END PLATE DETAILS

SECTION B-B

TABLE OF FLANGE DIMENSIONS				
TRUSS CHORD Outside Diameter & Thickness	BOLT SIZE	DIMENSION (INCHES)		
		A	B	C
6" x 1/4"	7/8"	13"	9"	5"
6 1/2" x 3/8"	7/8"	14"	10"	5 1/4"
7" x 3/8"	7/8"	14"	10"	5 3/4"
7" x 1/2"	7/8"	14"	10"	5 1/2"

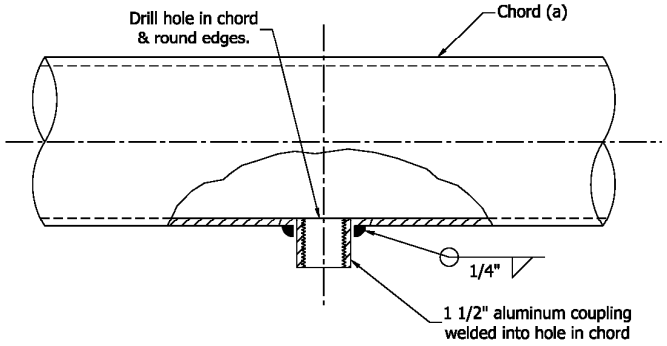


END VIEW



SECTION C-C

FLANGE DETAILS



WIRE OUTLET DETAIL

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
FLANGE, CHORD END PLATE, AND WIRE
OUTLET DETAILS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-06

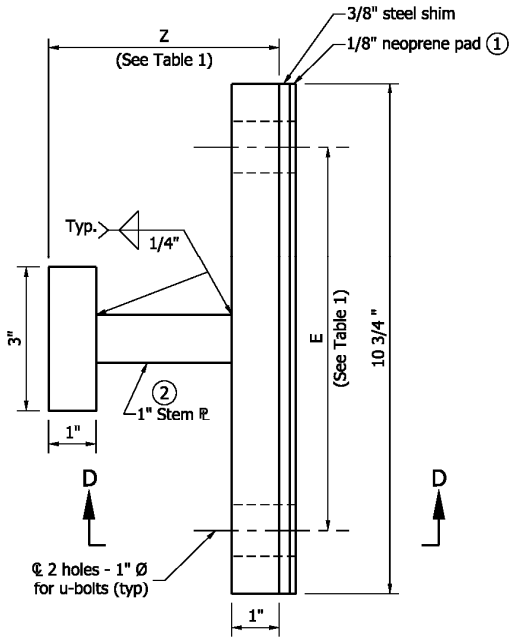
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

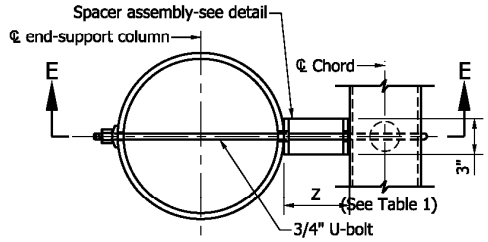
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

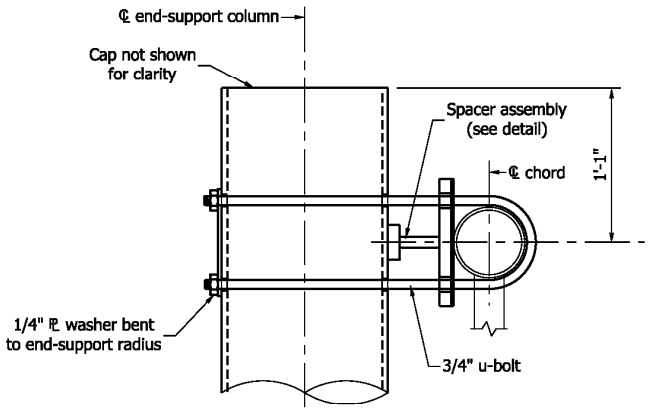
802-SBTS-07 SIGN BOX TRUSS STRUCTURE END-SUPPORT UPPER CHORD CONNECTION DETAILS (PROPOSED NEW DRAWING)



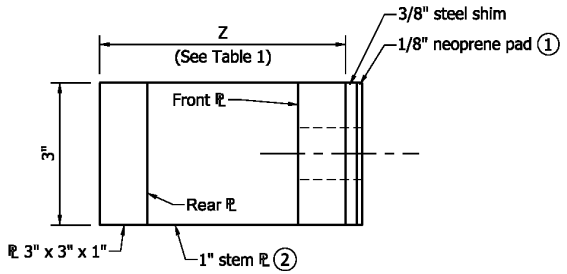
ELEVATION
END SUPPORT SPACER ASSEMBLY DETAIL



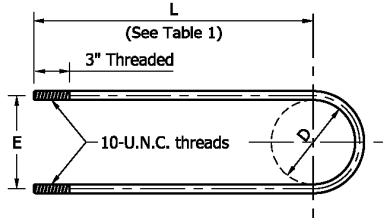
PLAN



SECTION E-E
UPPER CHORD CONNECTION DETAILS



SECTION D-D



3/4" DIA. STAINLESS STEEL U-BOLT DETAIL

NOTE:

① Provide isolation from steel dissimilar metal as required.

② *For trusses type D or E the 1" stem plate is not required. Filet weld front and rear plates together.

TABLE 1 - SPACER ASSEMBLY DIMENSIONS

TRUSS TYPE	END SUPPORT COLUMN SIZE (h)	CHORD (a)	Ø OF U-BOLT BEND	E	Z	L
	O.D. in.	O.D. in.	(D) in.	in.	in.	in.
A	14	6	6 1/16	6 13/16	4 1/2	24
B	14	6 1/2	6 9/16	7 5/16	4 1/4	24
C	14	7	7 1/16	7 13/16	4	24
D	18	7	7 1/16	7 13/16	2 *	26
E	18	7	7 1/16	7 13/16	2 *	26

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
END-SUPPORT
UPPER CHORD CONNECTION DETAILS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-07

DESIGN STANDARDS ENGINEER DATE

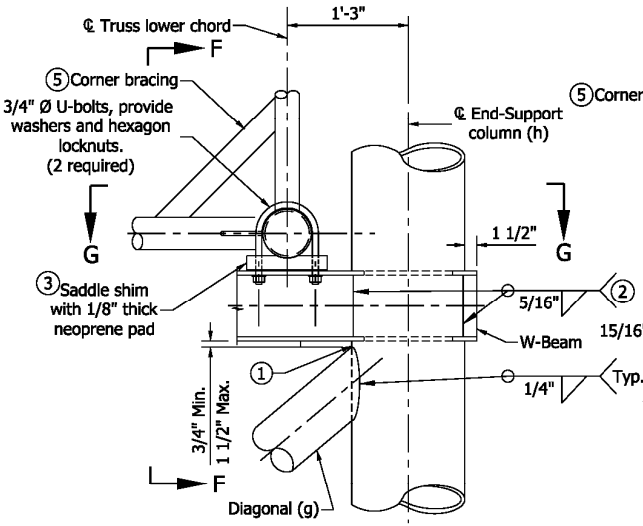
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

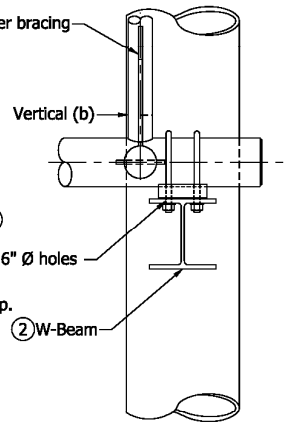
Item No. 02 12/17/09 (2010 SS)(contd.)
Mr. Wright
Date: 12/17/09

REVISION TO THE STANDARD DRAWINGS

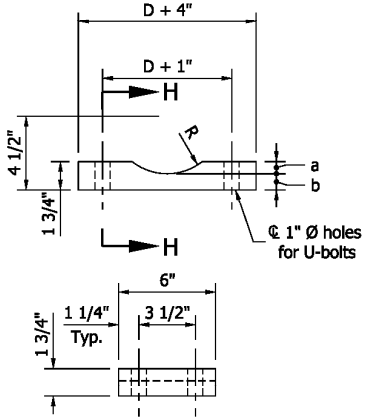
802-SBTS-08 SIGN BOX TRUSS STRUCTURE END-SUPPORT LOWER CHORD CONNECTIONS (PROPOSED NEW DRAWING)



LOWER CHORD CONNECTION DETAIL



SECTION F-F



SECTION H-H

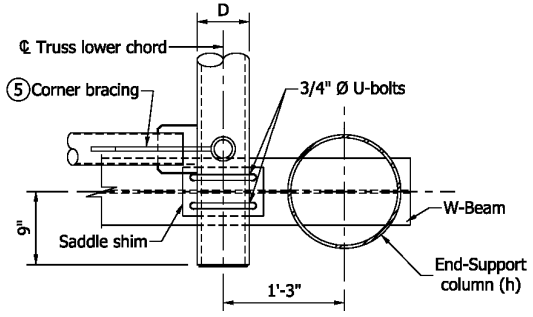
SADDLE SHIM DETAIL

NOTES:

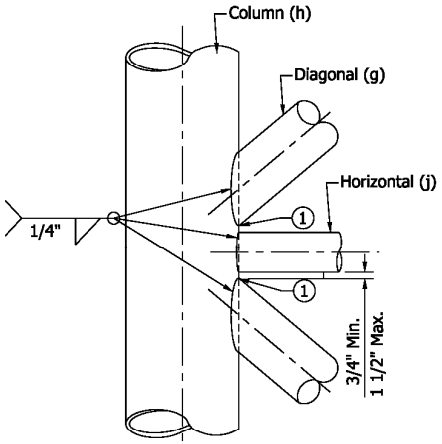
1. Toe edge of diagonal member shall be cut back to facilitate throat thickness. See Standard Drawing E 802-SBTS-17 for toe-edge detail.
2. Cut holes in end support columns for W-beams to pass through. Holes to have 1/8" maximum clearance to W-beam. Holes in opposite sides of column to be checked for proper alignment prior to cutting.
3. Provide neoprene pads at all chord to W-beam bearing surfaces.
4. See Standard Drawing E 802-SBTS-02 for End-Support member sizes.
5. A corner brace is required on each of the eight external corners of Exterior and Interior Sections. Brace shall be 1'-9"x3"x1/2". See Standard Drawing E 802-SBTS-05 for angle bracing. (Detail E)
6. Use Standard Drawing E 802-SBTS-08A for HSS Square-beam as alternate to truss supporting W-Beam.

D	a	b
6"	9/32"	1 15/32"
6 1/2"	17/32"	1 7/32"
7"	25/32"	31/32"

R = D/2 + 1/32"
D = outside diameter of chord.



SECTION G-G



ELEVATION (END-SUPPORT)
TYPICAL BRACING MEMBERS CONNECTION

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
END-SUPPORT
LOWER CHORD CONNECTIONS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-08

DESIGN STANDARDS ENGINEER DATE

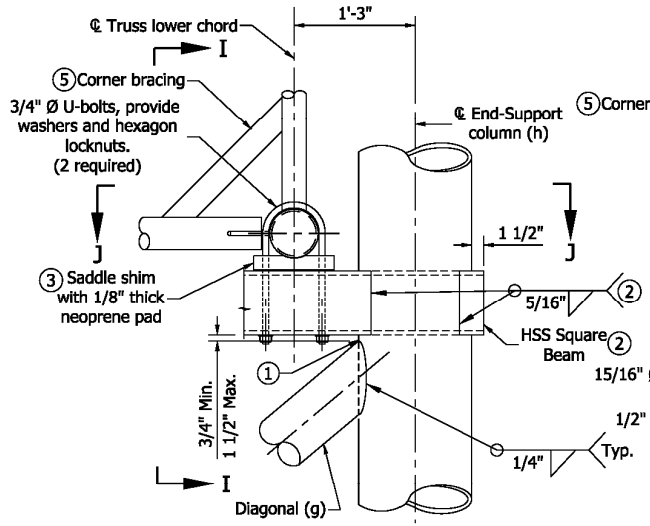
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

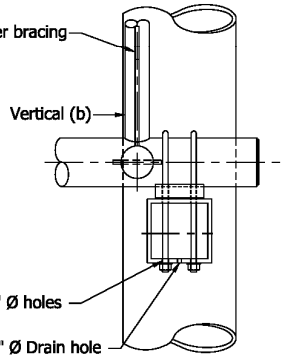
Item No. 02 12/17/09 (2010 SS)
Mr. Wright
Date: 12/17/09

REVISION TO THE STANDARD DRAWINGS

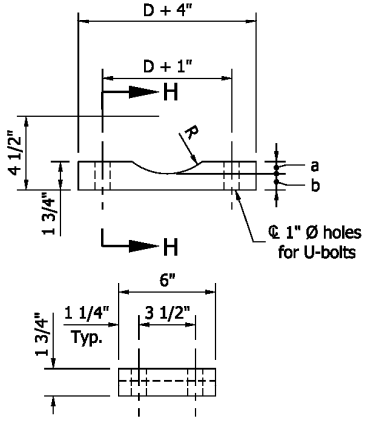
802-SBTS-08A SIGN BOX TRUSS STRUCTURE END-SUPPORT LOWER CHORD CONNECTIONS (PROPOSED NEW DRAWING)



LOWER CHORD CONNECTION DETAIL



SECTION I-I



SECTION H-H

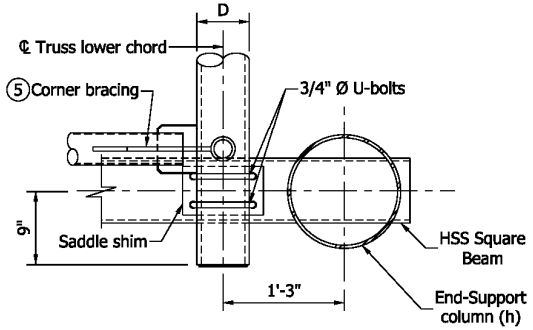
SADDLE SHIM DETAIL

NOTES:

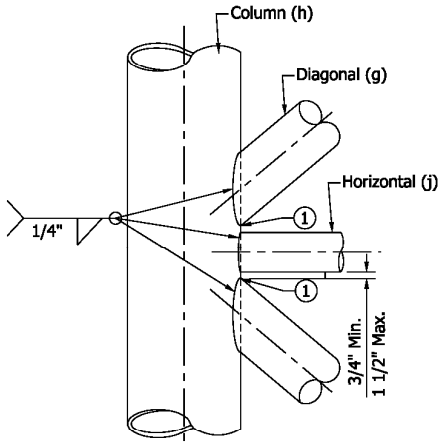
1. Toe edge of diagonal member shall be cut back to facilitate throat thickness. See Standard Drawing E 802-SBTS-17 for toe-edge detail.
2. Cut holes in end support columns for Square-beams to pass through. Holes to have 1/8" maximum clearance to Square-beam. Holes in opposite sides of column to be checked for proper alignment prior to cutting.
3. Provide neoprene pads at all chord to Square-beam bearing surfaces.
4. See Standard Drawing E 802-SBTS-02 for end support member sizes.
5. A corner brace is required on each of the eight external corners of Exterior and Interior Sections. Brace shall be 1'-9"x3"x1/2". See Standard Drawing E 802-SBTS-05 for angle bracing. (Detail E)

D	a	b
6"	9/32"	1 15/32"
6 1/2"	17/32"	1 7/32"
7"	25/32"	31/32"

R = D/2 + 1/32"
D = outside diameter of chord.



SECTION J-J



ELEVATION (END-SUPPORT)
TYPICAL BRACING MEMBERS CONNECTION

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
END-SUPPORT
LOWER CHORD CONNECTIONS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-08A

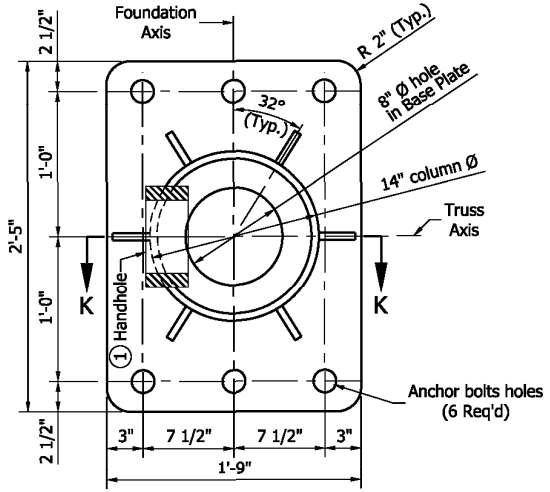
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

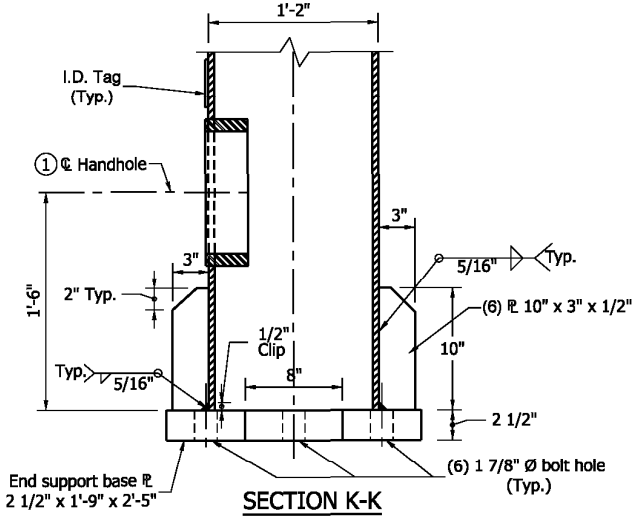
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

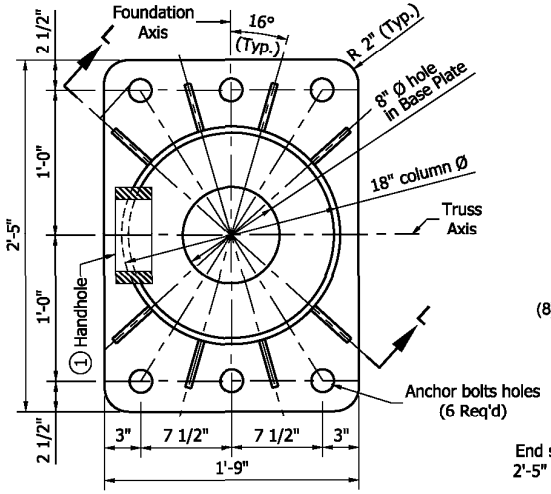
802-SBTS-09 SIGN BOX TRUSS STRUCTURE END-SUPPORT BASE PLATE DETAILS (PROPOSED NEW DRAWING)



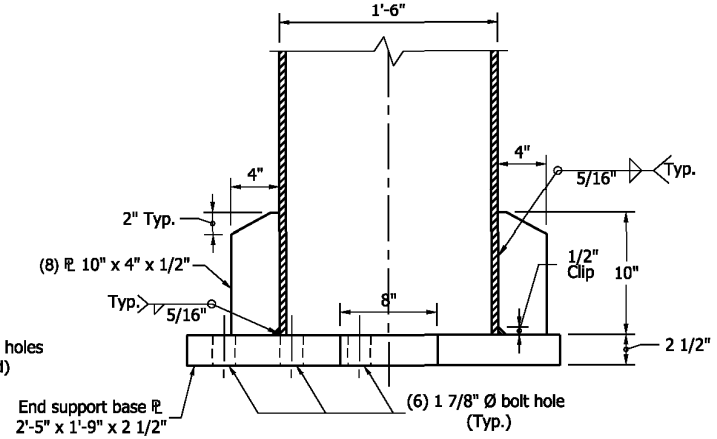
TYPE B-14 BASE PLATE



SECTION K-K



TYPE B-18 BASE PLATE



SECTION L-L

NOTES:

① See Standard Drawing E 802-SBTS-10 for handhole details.

2. Use type B-14 base plate for end-support column diameter of 14", or type B-18 for end-support column diameter of 18".

3. See Standard Drawing E 802-SBTS-11 for Anchor bolt details.

4. Each end-support shall have one hand hole at the column base(h). Hand hole shall be placed on the column nearest to the sign.

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
END-SUPPORT
BASE PLATE DETAILS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-09

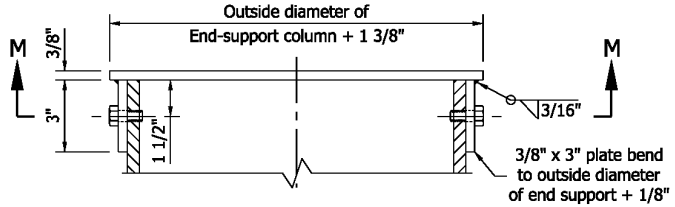
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

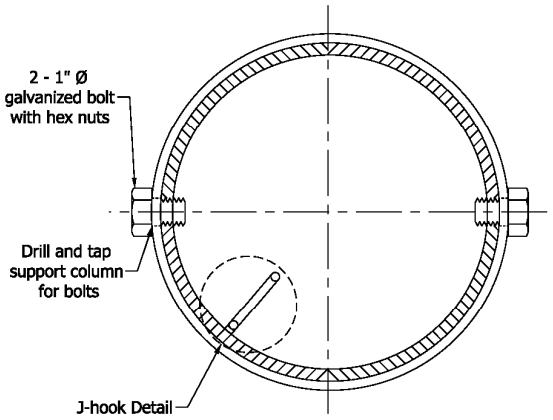
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-10 SIGN BOX TRUSS STRUCTURE END-SUPPORT TOP-CAP, J-HOOK & HANDHOLE DETAILS (PROPOSED NEW DRAWING)



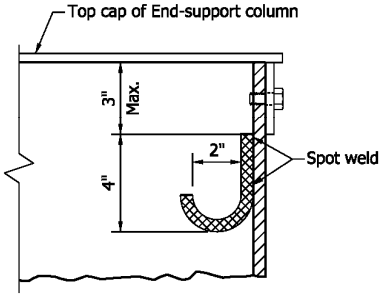
TOP CAP
ELEVATION VIEW



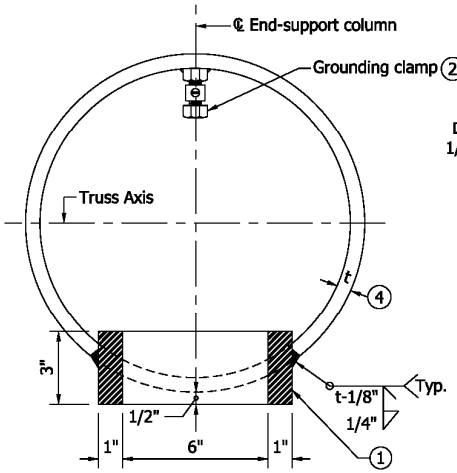
SECTION M-M

Notes

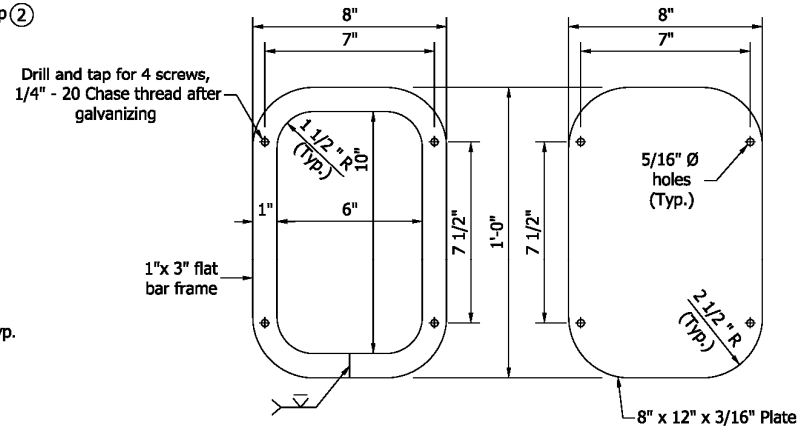
1. In lieu of fabricated handhole frame as shown, frame may be cut from 3" plate (rolling direction vertical).
2. See Standard Drawing E 802-SNWR-03 for grounding post details. Grounding post to be placed on far side of support directly opposite center of handhole.
3. See Standard Drawing E 802-SBTS-01 and 09 for handhole locations.
4. See Standard Drawing E 802-SBTS-02 for thicknesses of End-support columns.



J-HOOK DETAIL



HANDHOLE
SECTION ACROSS COLUMN



HANDHOLE FRAME DETAIL

HANDHOLE COVER

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
END-SUPPORT
TOP-CAP, J-HOOK & HANDHOLE DETAILS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-10

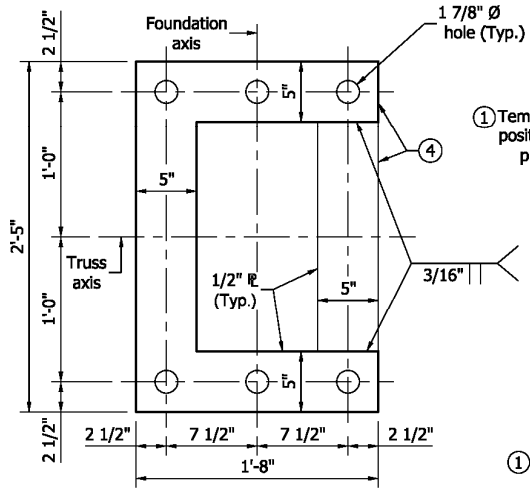
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

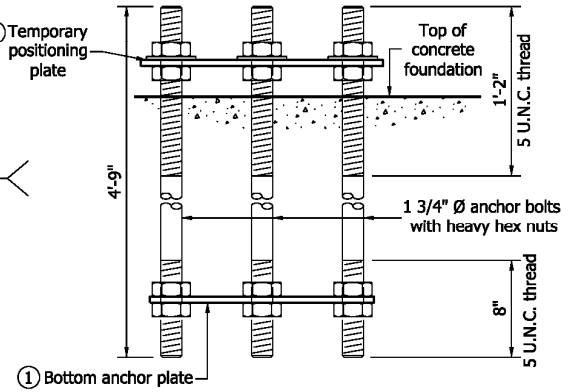
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-11 SIGN BOX TRUSS STRUCTURE END-SUPPORT ANCHOR BOLTS AND SKIRT DETAILS (PROPOSED NEW DRAWING)



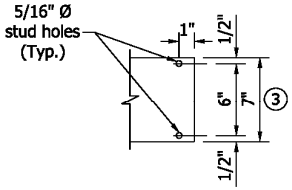
TEMPORARY POSITIONING PLATE



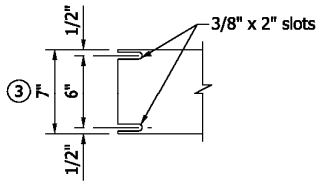
ANCHOR BOLT DETAILS
BEFORE CONCRETE PLACEMENT

NOTES:

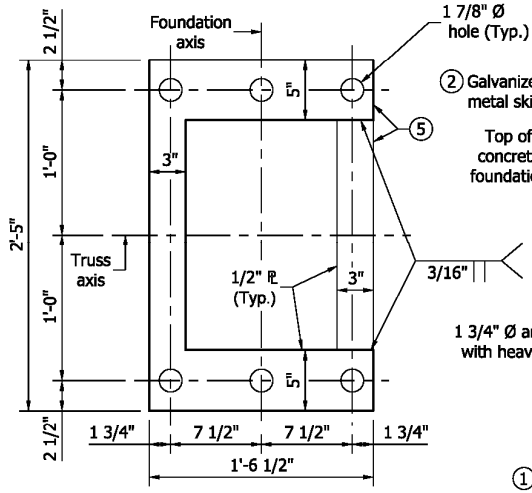
1. Use temporary positioning plate and bottom anchor plate for all foundations. Temporary positioning plate should be removed after placing concrete.
2. Secure galvanized metal skirt to base plate after erection as shown in skirt detail.
3. Minimum base plate gap is 2 1/2" and can be increased up to 5 1/2". Metal skirt width shall be at least 1 1/2" more than the actual gap.
4. Optionally may use four separate (4) 5" plates welded together to maintain angles and shape as shown.
5. Optionally may use four separate (2) 3" and (2) 5" plates welded together to maintain angles and shape as shown.
6. For base plate of End-support details see Standard Drawing E 802-SBTS-09.



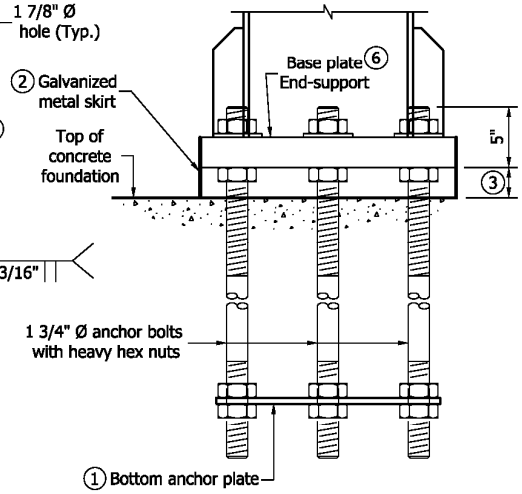
DETAIL "G"



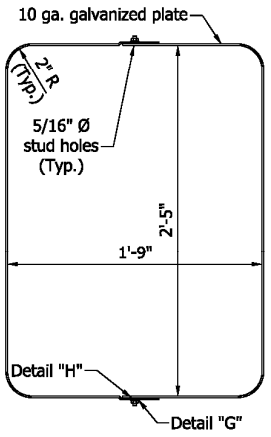
DETAIL "H"



BOTTOM ANCHOR PLATE



ANCHOR BOLT DETAILS
AFTER CONCRETE PLACEMENT



SKIRT DETAIL

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
END-SUPPORT
ANCHOR BOLTS AND SKIRT DETAILS
JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-11

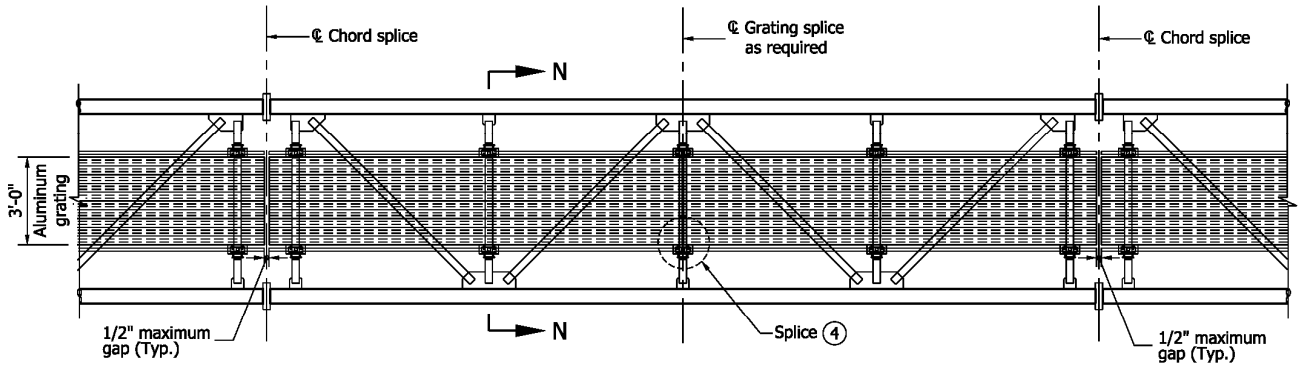
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-12 SIGN BOX TRUSS STRUCTURE INTERIOR-WALKWAY-GRATING DETAILS (PROPOSED NEW DRAWING)



WALKWAY GRATING PLAN

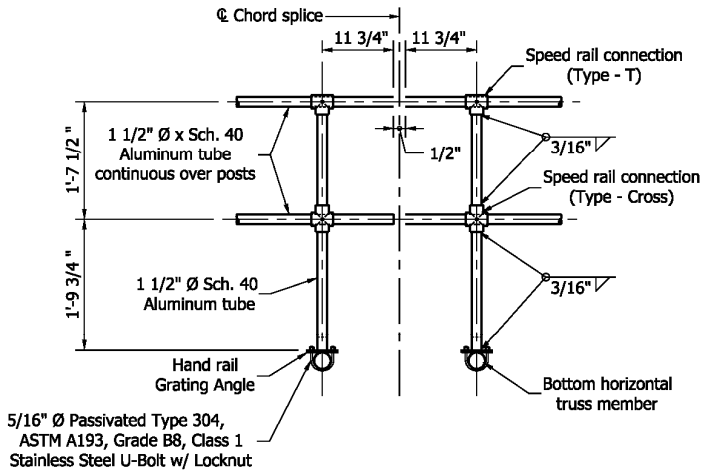
NOTES:

1. Interior walkway gratings are extruded I-Bars 1 1/2" x 3/16" - 11/16" center to center, cross bars shall have a maximum gap of 4". Weight = 4.42 lbs/ft² A different grating of equal strength may be used upon approval.
2. Walkway grating top surface shall be deformed to allow for better traction.

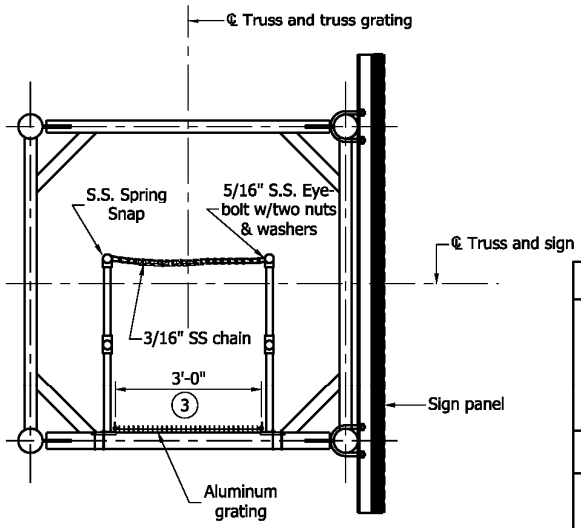
(3) Walkway grating width is nominal and may very ± 1/2" based on available standard widths.

(4) Interior walkway gratings can be spliced on center of any horizontals truss members as needed. See Standard Drawing E 802-SBTS-13 for typical interior walkway grating splice detail.

5. Interior walkway grating shall run the full length center to center of End-support truss members plus 9" at each end.



TYPICAL HANDRAIL DETAIL



SECTION N-N

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
INTERIOR-WALKWAY-GRATING DETAILS

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-12

DESIGN STANDARDS ENGINEER DATE

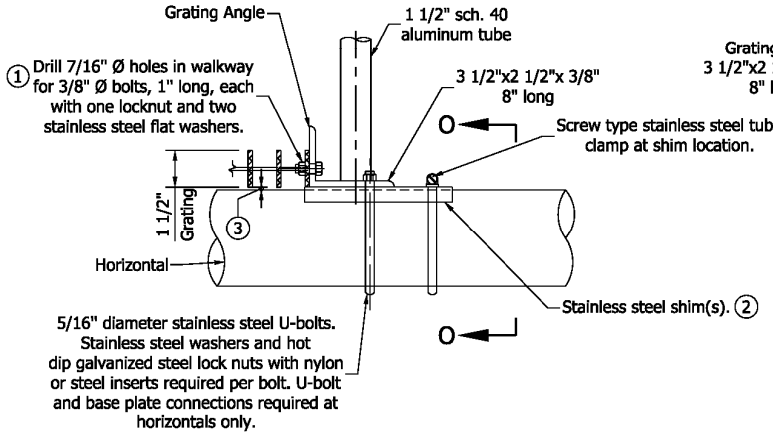
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

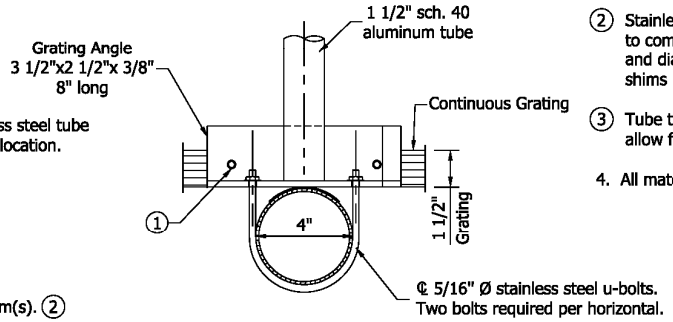
Item No. 02 12/17/09 (2010 SS)(contd.)
Mr. Wright
Date: 12/17/09

REVISION TO THE STANDARD DRAWINGS

802-SBTS-13 SIGN BOX TRUSS STRUCTURE INTERIOR-WALKWAY-GRATING DETAILS (PROPOSED NEW DRAWING)



GRATNG SUPPORT DETAIL



SECTION O-O

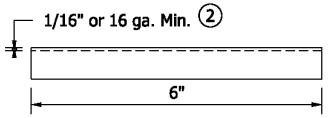
Notes:

① Drilling holes in grating may be done in shop or field, based on Contractor's preference and subject to accurate alignment.

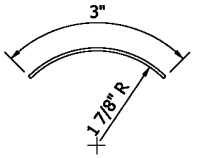
② Stainless steel shims may be placed as shown in Details if needed to compensate for alignment variations between horizontal and diagonal pipes beyond adjustment provided by angles. Thicker shims may be used subject to shims performing properly.

③ Tube to grating gap may vary from 0 to 1/2", max. to align walkway, allow for camber, etc.

4. All materials shall be Aluminum 606I-T6 unless otherwise noted.

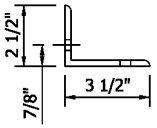


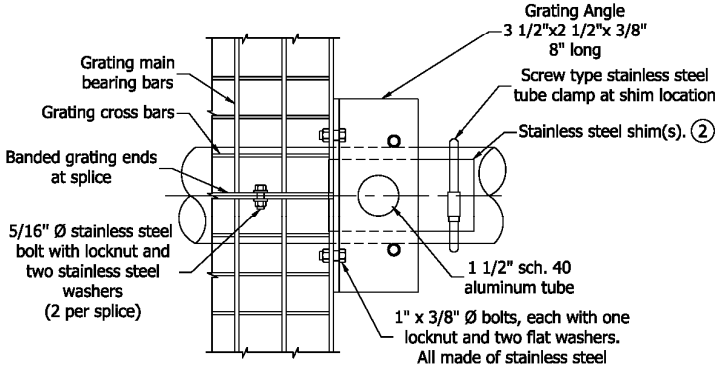
ELEVATION



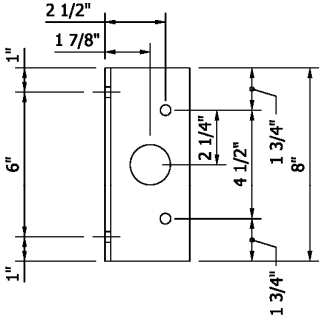
END VIEW

SHIM DETAIL





GRATING SPLICE DETAIL



GRATING ANGLE

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
INTERIOR-WALKWAY-GRATING DETAILS

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-13

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

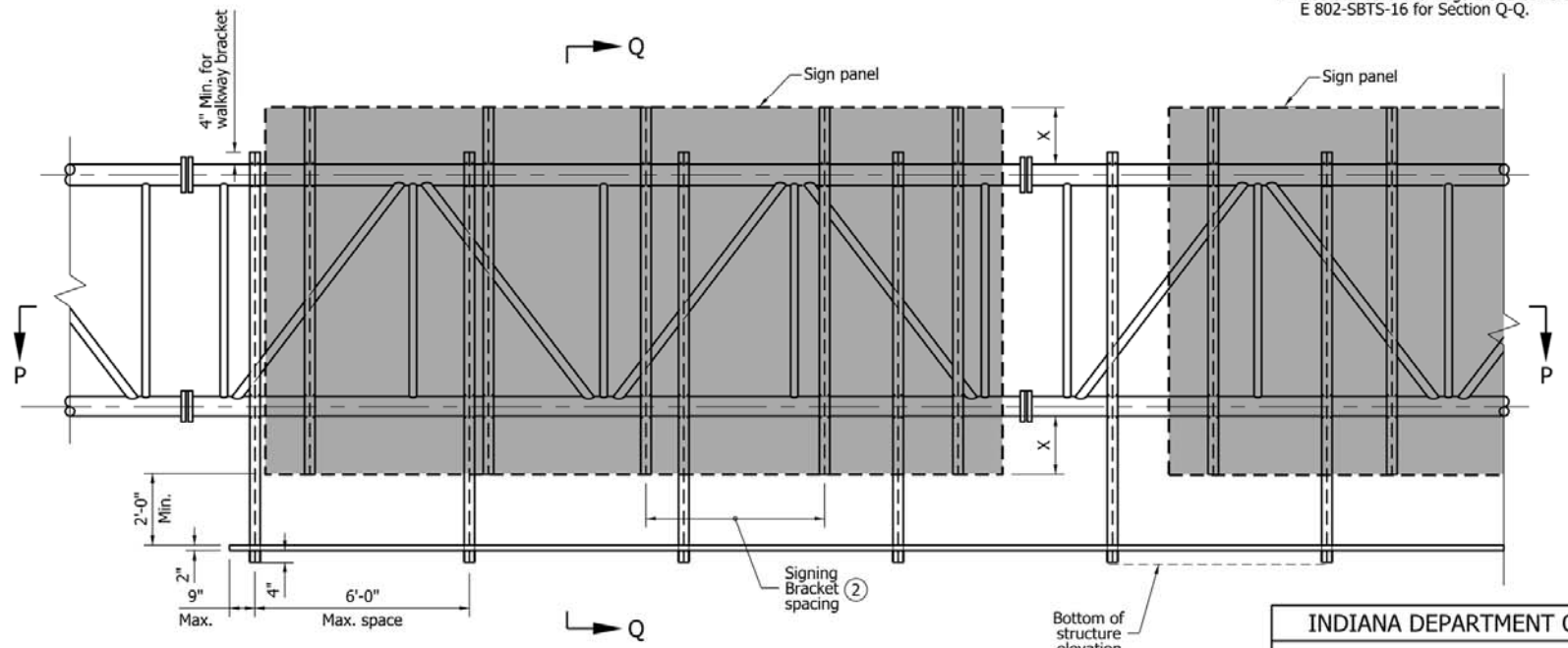
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-14 SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY (PROPOSED NEW DRAWING)

NOTE:

1. For location and data of sign panels see plan details. (Cross Section)
2. Signs > 7' in height, brackets spacing 5' max.
   Signs ≤ 7' in height, brackets spacing 7' max.
3. Dimension "X" depends on the height of the sign.
   Sign is to be centered on truss.
4. See Standard Drawings E 802-SBTS-15 for Section P-P, and E 802-SBTS-16 for Section Q-Q.



TYPICAL FRONT ELEVATION
(Lights & handrail omitted for clarity)

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
LIGHTING WALKWAY

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-14

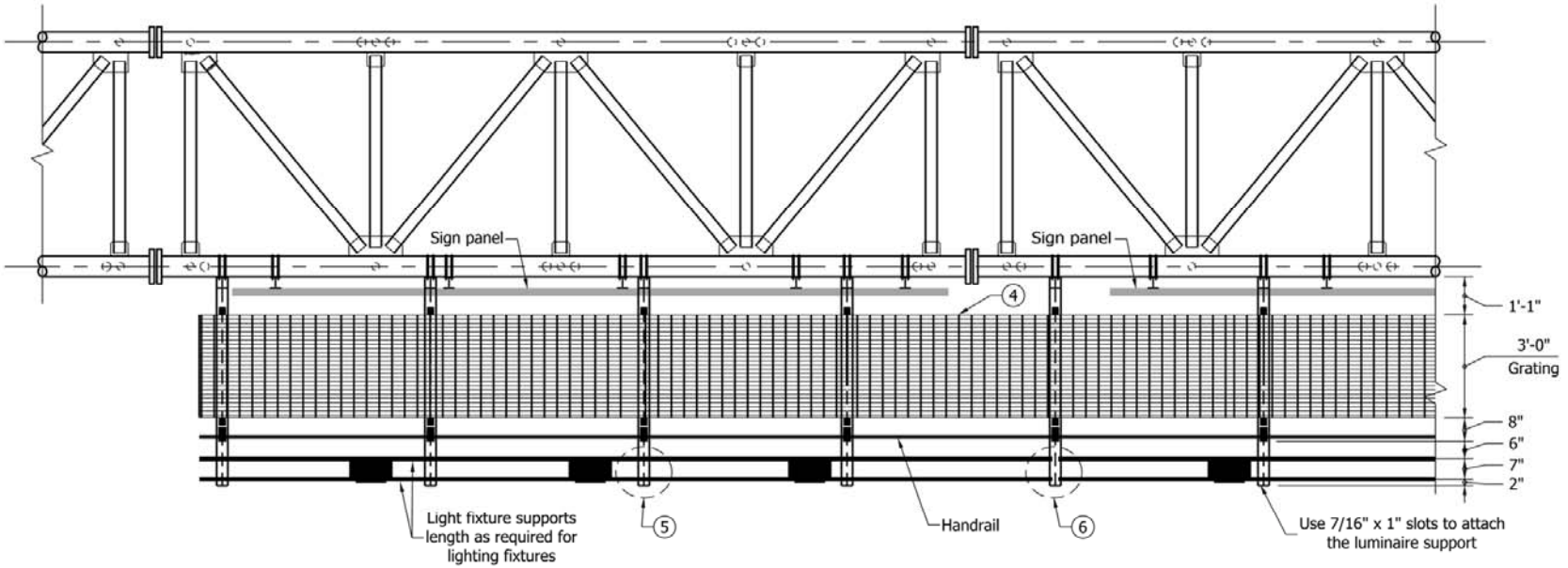
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-15 SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY (PROPOSED NEW DRAWING)



SECTION P-P

NOTES:

1. The top surface of the walkway grating shall be deformed to allow for better traction.
2. Handrail and grating shall span a minimum of 3 brackets.
3. Grating splice location on center of L-bracket only.

(4) Lighting walkway gratings are extruded I-Bars 1 1/2" x 3/16" - 11/16" center to center, cross bars shall have a maximum gap of 4".
Weight = 4.42 lbs/ft²
A different grating of equal strength may be used upon approval.

(5) See Standard Drawing E 802-SBTS-19 for Detail L.

(6) See Standard Drawing E 802-SBTS-19 for Detail M.

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
LIGHTING WALKWAY

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-15

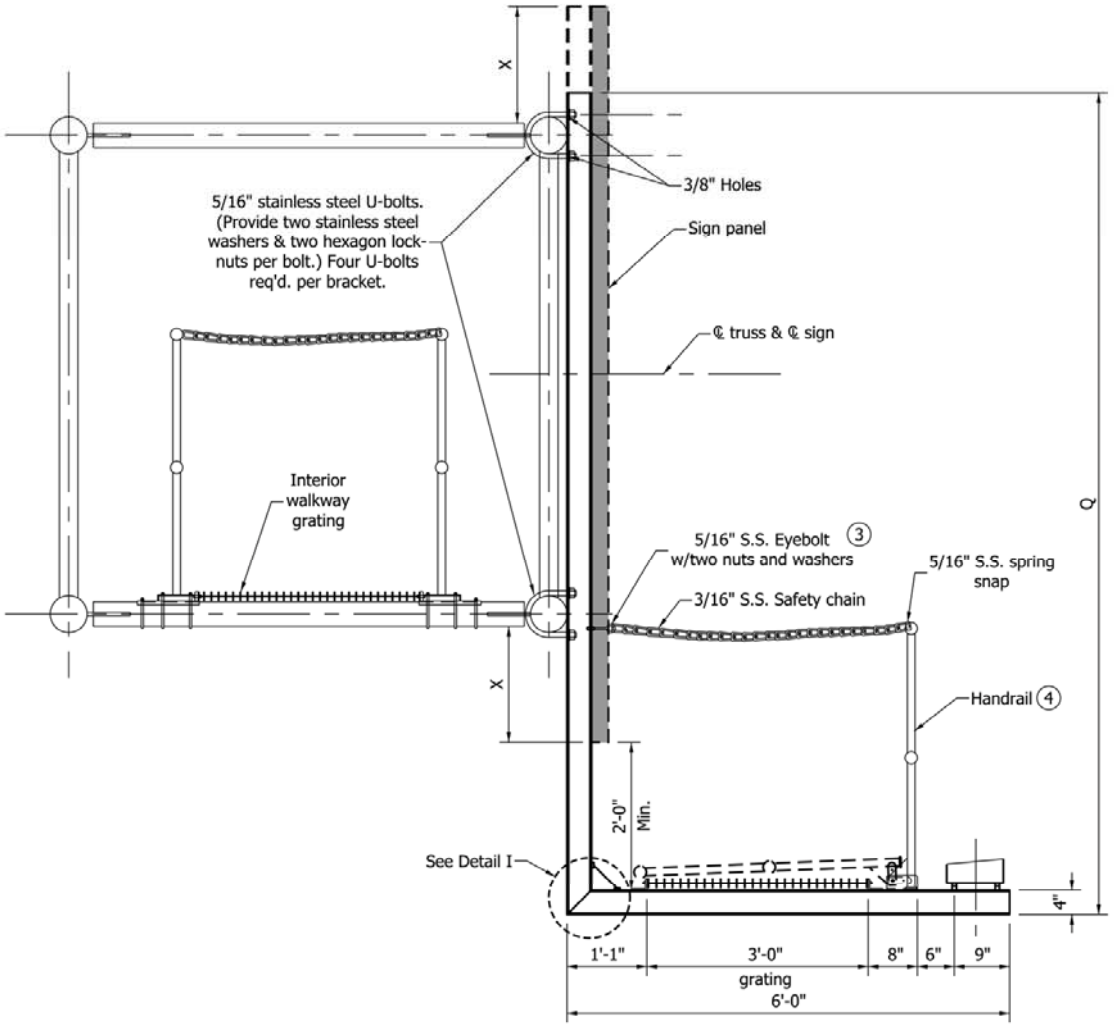
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

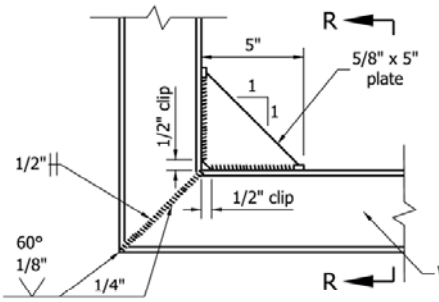
802-SBTS-16 SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY PROFILE (PROPOSED NEW DRAWING)



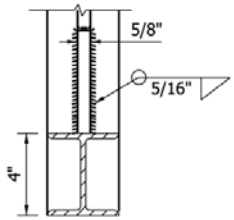
SECTION Q-Q

NOTES:

1. Dimensions X and Q to be determined by contractor to fit signs involved.
2. Sign panel shall be placed symmetrically about ℄ truss.
3. Eyebolt shall be attached to web of bracket of approximately elevation of upper handrail pipe.
4. See Standard Drawing E 802-SBTS-17 for handrail details.



DETAIL I



SECTION R-R

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
LIGHTING WALKWAY PROFILE

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-16

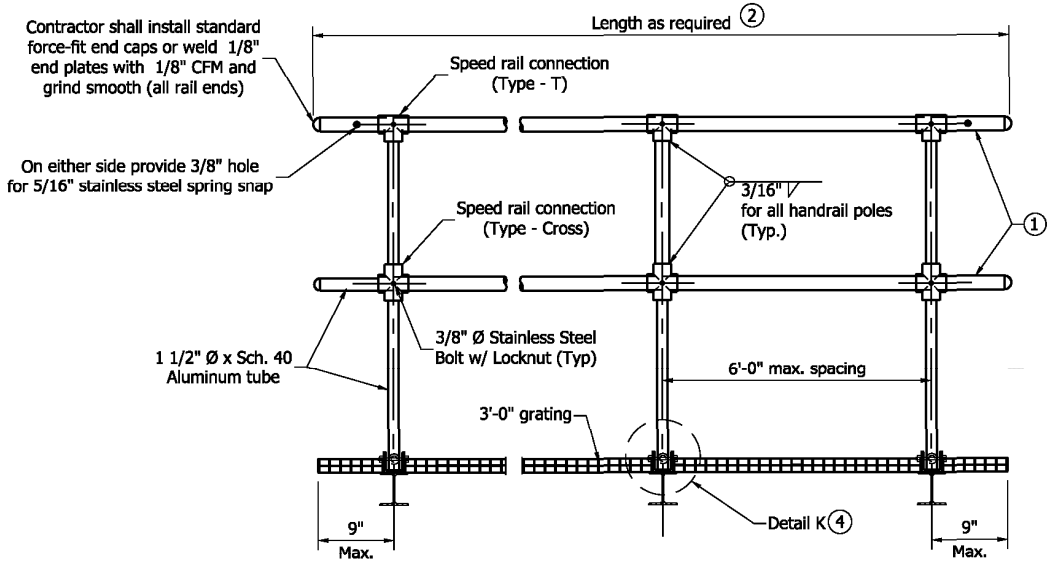
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

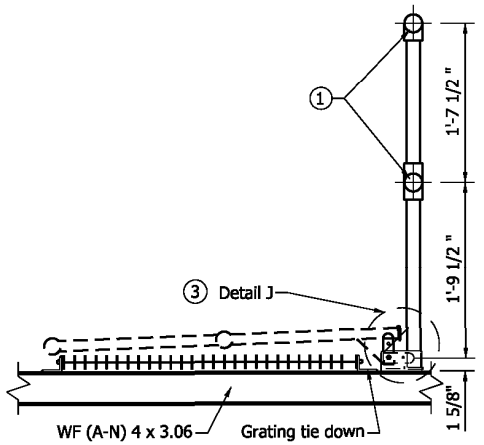
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-SBTS-17 SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY/HANDRAIL ASSEMBLY (PROPOSED NEW DRAWING)



FRONT ELEVATION



SIDE ELEVATION

NOTES:

① Horizontal rail member shall be continuous through fitting. Manufacture will Provide 7/16" holes for fitting 3/8" bolt. Field drill 7/16" hole in horizontal rail member. Attach handrail with 3/8" bolt, washer & locknut.

② Rail and grating shall span a minimum of three brackets.

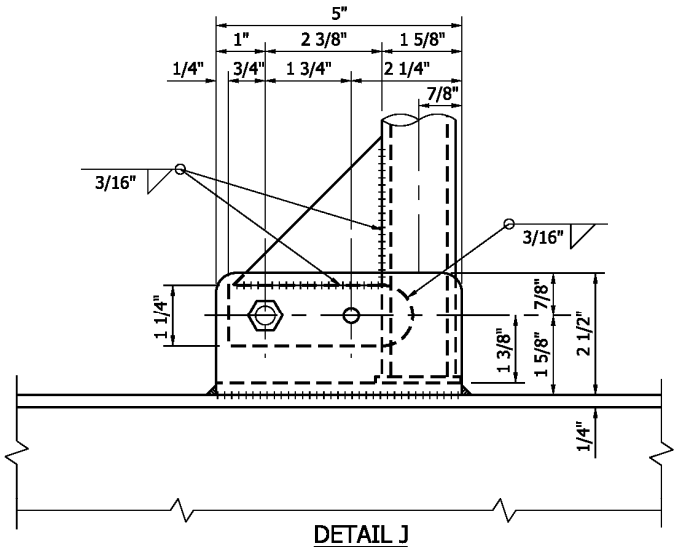
③ See Standard Drwaing E 802-SBTS-18 for Detail J.

④ See Standard Drwaing E 802-SBTS-18 for Detail K.

INDIANA DEPARTMENT OF TRANSPORTATION	
SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY/ HANDRAIL ASSEMBLY JUNE 2009	
STANDARD DRAWING NO. E 802-SBTS-17	
	DESIGN STANDARDS ENGINEER DATE CHIEF HIGHWAY ENGINEER DATE
DESIGN STANDARDS ENGINEER	

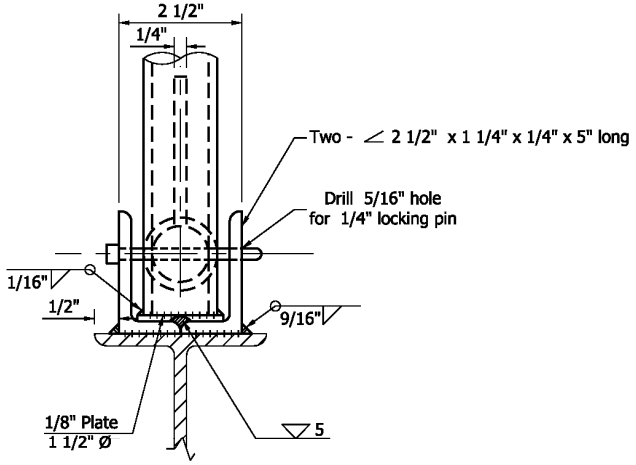
REVISION TO THE STANDARD DRAWINGS

802-SBTS-18 SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY, HANDRAIL HINGE AND GRATING DETAILS (PROPOSED NEW DRAWING)



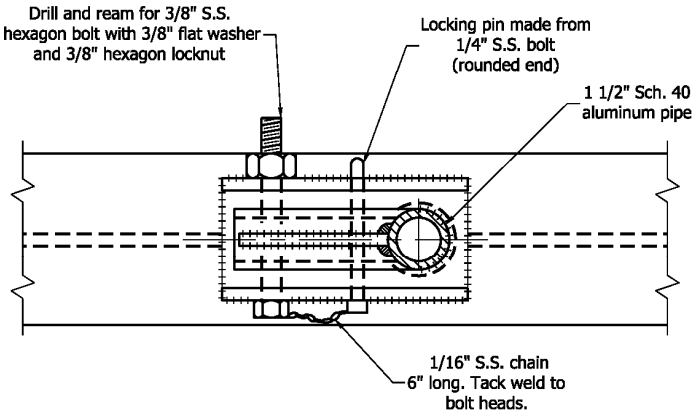
DETAIL J

SIDE ELEVATION



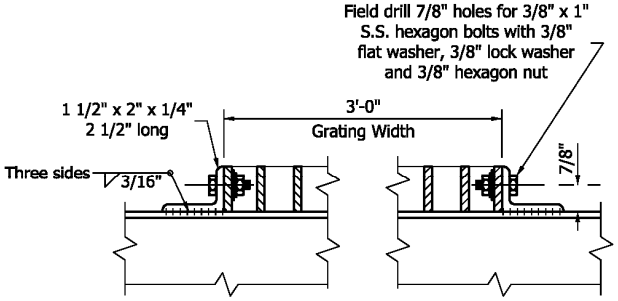
DETAIL K

FRONT ELEVATION



PLAN

DETAILS OF HANDRAIL HINGE



GRATING TIE DOWN

(Two req'd per walkway bracket)

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
LIGHTING WALKWAY, HANDRAIL HINGE AND
GRATING DETAILS

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-18

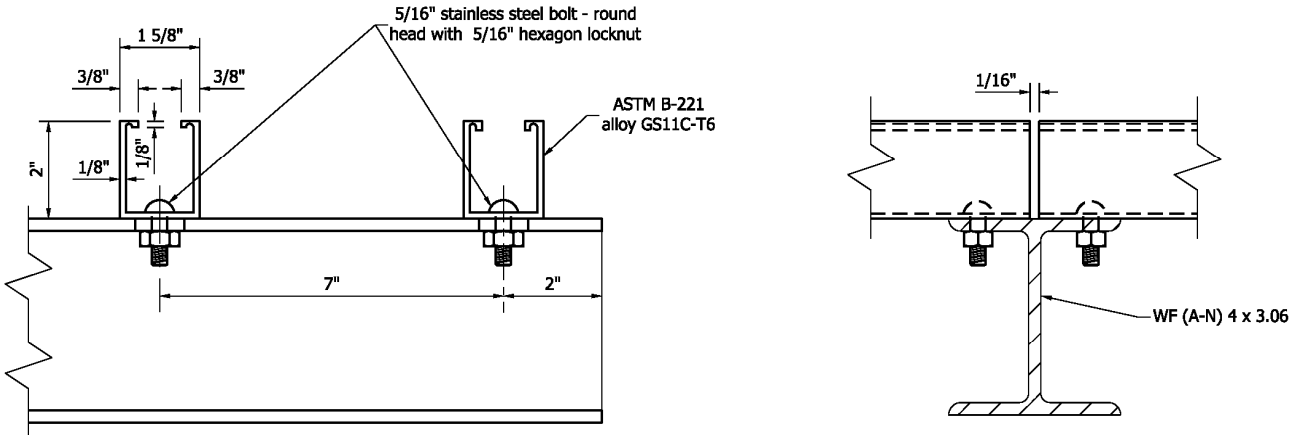
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

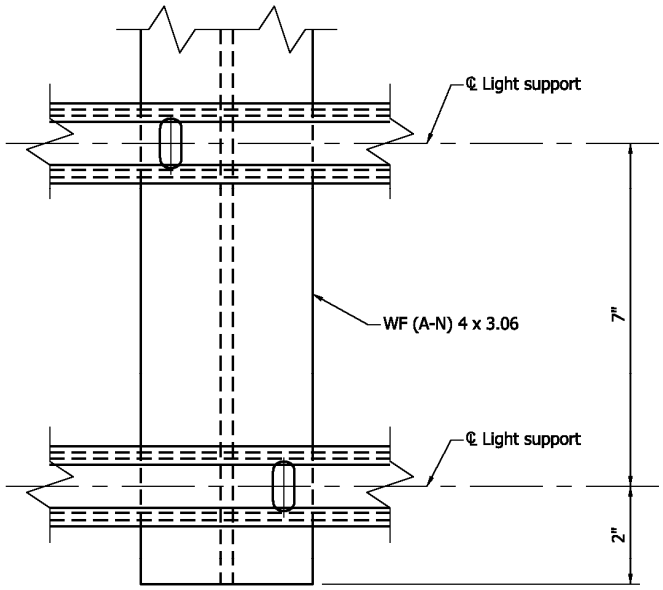
REVISION TO THE STANDARD DRAWINGS

802-SBTS-19 SIGN BOX TRUSS STRUCTURE LIGHTING WALKWAY FIXTURE MOUNT DETAILS (PROPOSED NEW DRAWING)

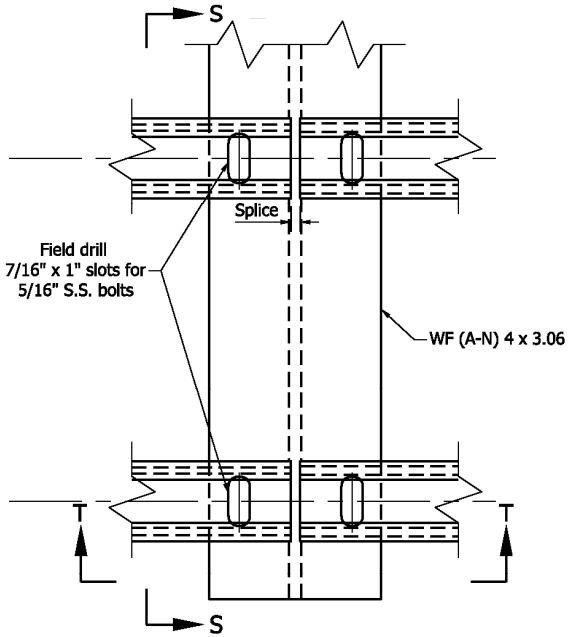


SECTION S-S

SECTION T-T



DETAIL L



DETAIL M

INDIANA DEPARTMENT OF TRANSPORTATION

SIGN BOX TRUSS STRUCTURE
LIGHTING WALKWAY
FIXTURE MOUNT DETAILS

JUNE 2009

STANDARD DRAWING NO. E 802-SBTS-19

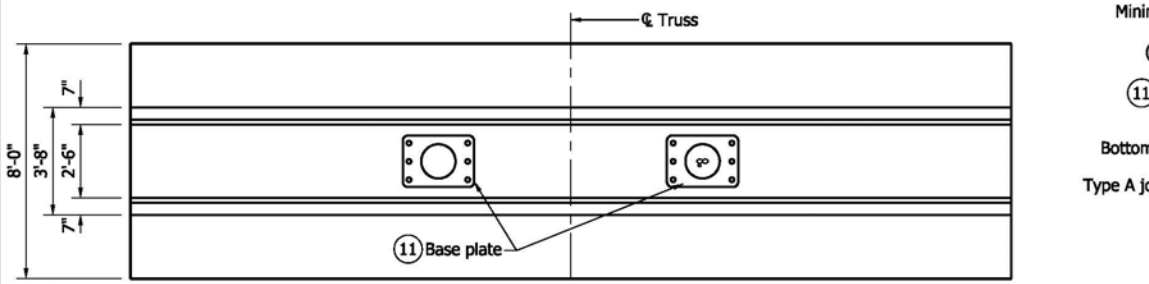
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

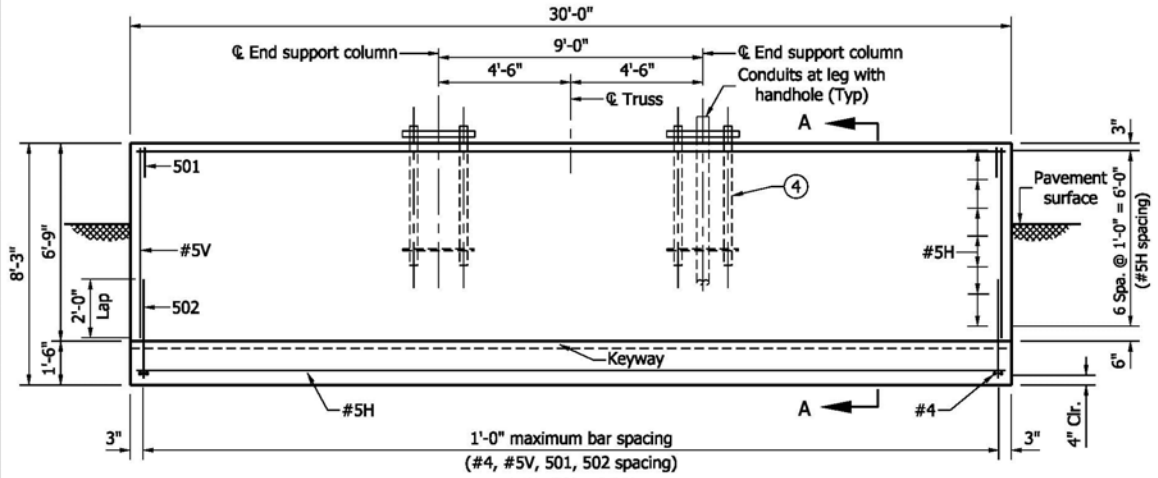
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

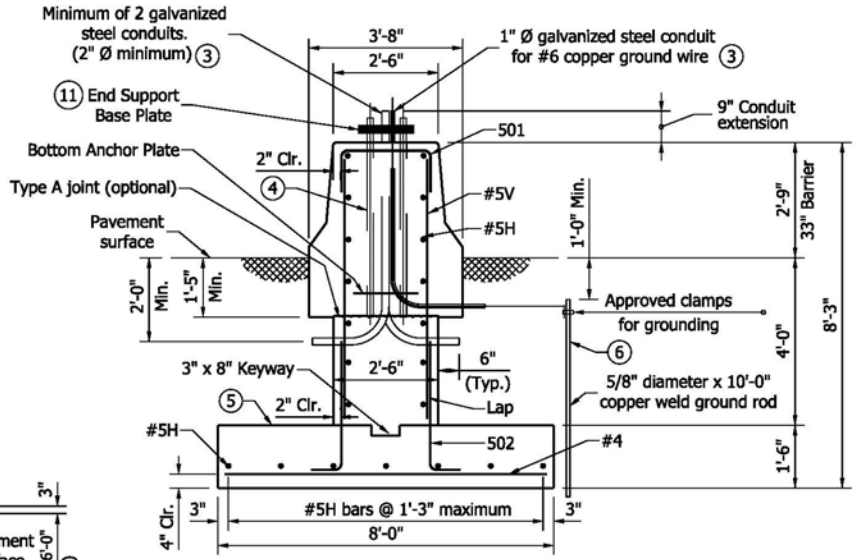
802-BTSF-01 BOX TRUSS STRUCTURE FOUNDATION SPREAD FOUNDATION AT 33" HEIGHT CONCRETE BARRIER (PROPOSED NEW DRAWING)



PLAN



ELEVATION



SECTION A-A

Legend:
H = Horizontal Bar
V = Vertical Bar

Notes:

1. This standard foundation design is applicable for Box Truss spans of 130' or less, truss mounting heights of 28'-6" or less and sign areas of 900 ft.² or less.
2. The design is based on maximum gross soil bearing pressure = 1500 psf.
3. Thread and cap both ends of steel conduit.
4. See Standard Drawing E 802-SBTS-11 for anchor bolts details.
5. The top of the footing shall be a minimum of 4 ft. below the pavement or ground surface.
6. Only one ground rod per structure is required.
7. All reinforcement to be epoxy coated.
8. See Standard Drawing E 602-CCMB-03 for concrete barrier width transition.
9. See Standard Drawing E 802-BTSF-04 for bill of materials and reinforcing bar bending details.
10. Top of foundation to be level.
11. See Standard Drawing E 802-SBTS-09 for base plate details.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
SPREAD FOUNDATION
AT 33" HEIGHT CONCRETE BARRIER
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-01

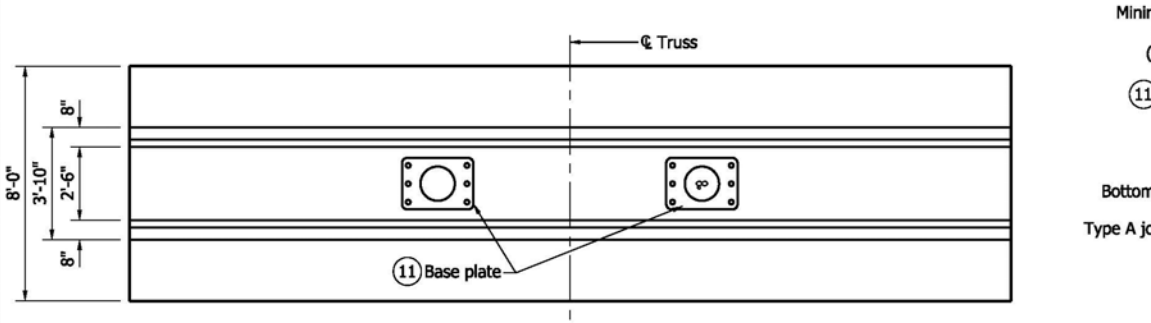
DESIGN STANDARDS ENGINEER

DESIGN STANDARDS ENGINEER DATE

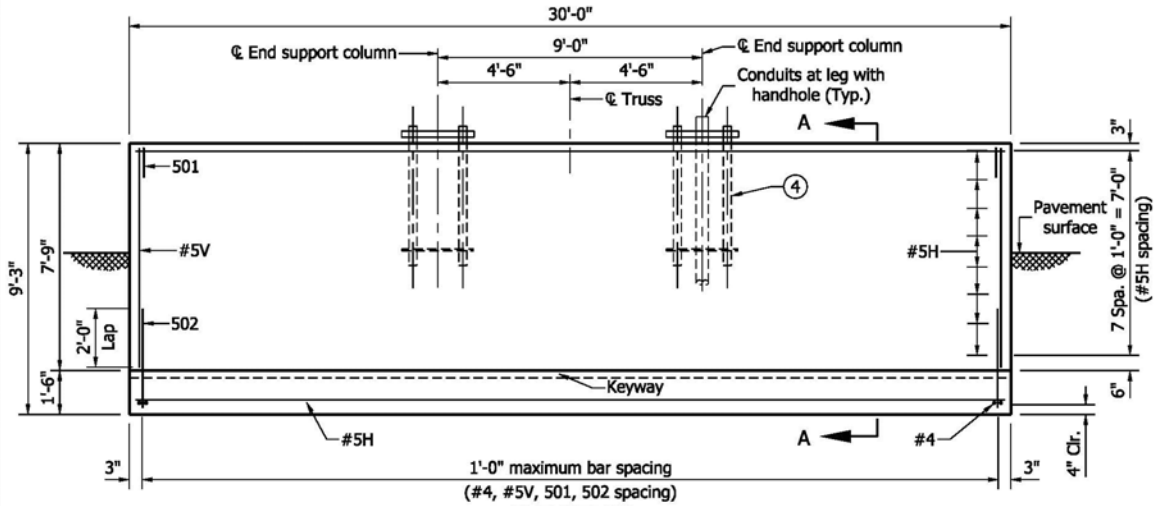
CHIEF HIGHWAY ENGINEER DATE

REVISION TO THE STANDARD DRAWINGS

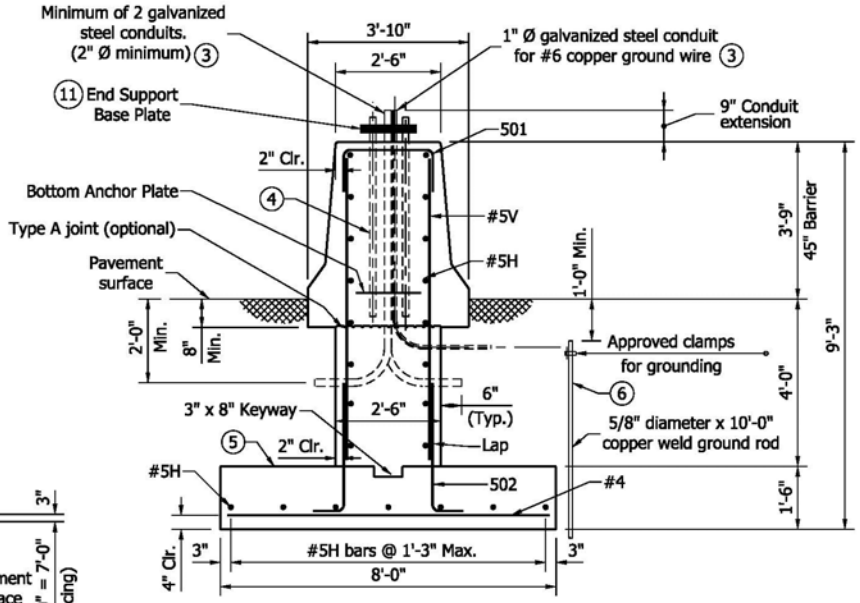
802-BTSF-02 BOX TRUSS STRUCTURE FOUNDATION SPREAD FOUNDATION AT 45" HEIGHT CONCRETE BARRIER (PROPOSED NEW DRAWING)



PLAN



ELEVATION



SECTION A-A

Legend:
H = Horizontal Bar
V = Vertical Bar

Notes:

1. This standard foundation design is applicable for Box Truss spans of 130' or less, truss mounting heights of 28'-6" or less and sign areas of 900 ft.² or less.
2. The design is based on maximum gross soil bearing pressure = 1500 psf.
3. Thread and cap both ends of steel conduit.
4. See Standard Drawing E 802-SBTS-11 for anchor bolts details.
5. The top of the footing shall be a minimum of 4 ft. below the pavement or ground surface.
6. Only one ground rod per structure is required.
7. All reinforcement to be epoxy coated.
8. See Standard Drawing E 602-CCMB-03 for concrete barrier width transition.
9. See Standard Drawing E 802-BTSF-04 for bill of materials and reinforcing bar bending details.
10. Top of foundation to be level.
11. See Standard Drawing E 802-SBTS-09 for base plate details.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
SPREAD FOUNDATION
AT 45" HEIGHT CONCRETE BARRIER
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-02

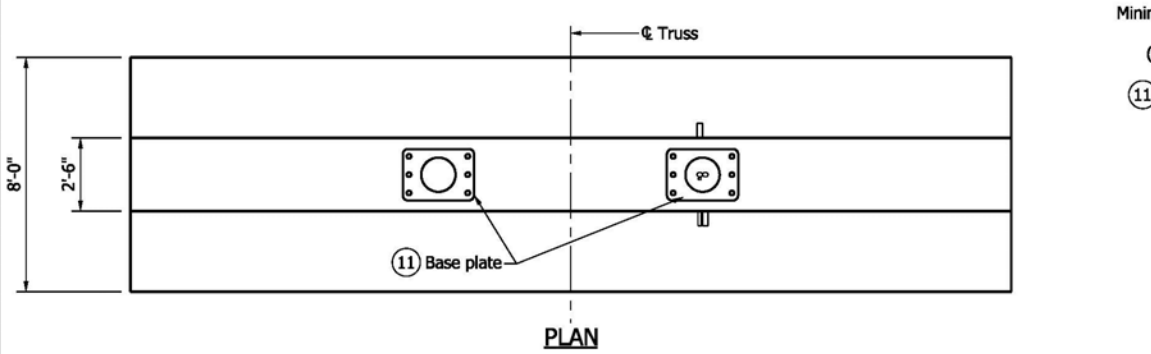
DESIGN STANDARDS ENGINEER

DESIGN STANDARDS ENGINEER DATE

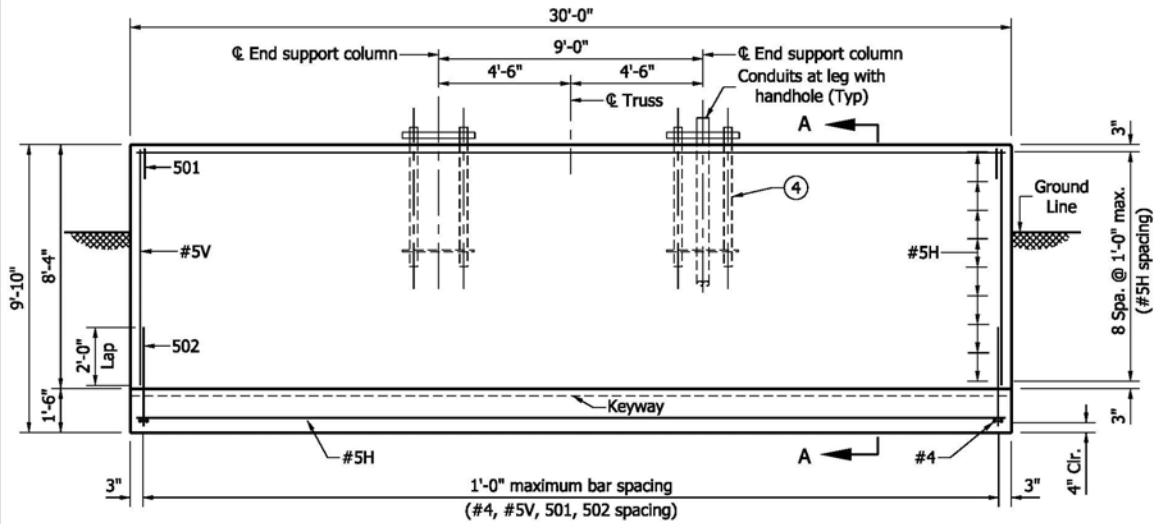
CHIEF HIGHWAY ENGINEER DATE

REVISION TO THE STANDARD DRAWINGS

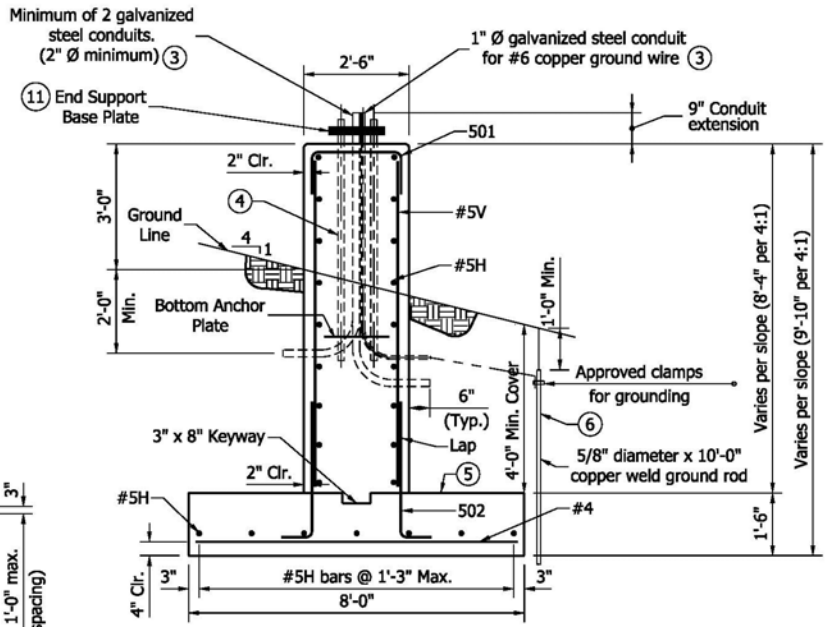
802-BTSF-03 BOX TRUSS STRUCTURE FOUNDATION SPREAD FOUNDATION WITHOUT CONCRETE BARRIER (PROPOSED NEW DRAWING)



PLAN



ELEVATION



SECTION A-A

Legend:
H = Horizontal Bar
V = Vertical Bar

Notes:

1. This standard foundation design is applicable for Box Truss spans of 130' or less, truss mounting heights of 28'-6" or less and sign areas of 900 ft.² or less.
2. The design is based on maximum gross soil bearing pressure = 1500 psf.
3. Thread and cap both ends of steel conduit.
4. See Standard Drawing E 802-SBTS-11 for anchor bolts details.
5. The top of the footing shall be a minimum of 4 ft. below the pavement or ground surface.
6. Only one ground rod per structure is required.
7. All reinforcement to be epoxy coated.
8. See Standard Drawing E 602-CCMB-03 for concrete barrier width transition.
9. See Standard Drawing E 802-BTSF-04 for bill of materials and reinforcing bar bending details.
10. Top of foundation to be level.
11. See Standard Drawing E 802-SBTS-09 for base plate details.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
SPREAD FOUNDATION
WITHOUT CONCRETE BARRIER
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-03

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

802-BTSF-04 BOX TRUSS STRUCTURE FOUNDATION SPREAD FOUNDATION BILLS OF MATERIALS (PROPOSED NEW DRAWING)

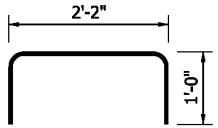
Notes:

1. See Standard Drawing E 802-BTSF-01 for spread foundation at 33" height concrete barrier.
2. See Standard Drawing E 802-BTSF-02 for spread foundation at 45" height concrete barrier.
3. See Standard Drawing E 802-BTSF-03 for spread foundation without concrete barrier.
4. Each bill of materials is for one spread foundation size and type.
5. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending requirements.

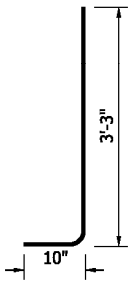
FOUNDATION AT 33" HEIGHT CONCRETE BARRIER WALL			
EPOXY-COATED REINFORCING BARS			
SIZE & MARK	NO. OF BARS	LENGTH	WEIGHT
501	31	4'-2"	
502	62	4'-1"	
#5V	62	6'-6"	
#5H	20	29'-8"	
TOTAL #5			1438 LBS.
#4	31	7'-8"	
TOTAL #4			159 LBS.
TOTAL EPOXY-COATED REINFORCING BARS			1597 LBS.
CONCRETE, CLASS "A"			35.8 CYS.
SURFACE SEAL			27.6 SYS.

FOUNDATION AT 45" HEIGHT CONCRETE BARRIER WALL			
EPOXY-COATED REINFORCING BARS			
SIZE & MARK	NO. OF BARS	LENGTH	WEIGHT
501	31	4'-2"	
502	62	4'-1"	
#5V	62	7'-6"	
#5H	22	29'-8"	
TOTAL #5			1565 LBS.
#4	31	7'-8"	
TOTAL #4			159 LBS.
TOTAL EPOXY-COATED REINFORCING BARS			1724 LBS.
CONCRETE, CLASS "A"			37.6 CYS.
SURFACE SEAL			34.3 SYS.

FOUNDATION WITHOUT BARRIER WALL			
EPOXY-COATED REINFORCING BARS			
SIZE & MARK	NO. OF BARS	LENGTH	WEIGHT
501	31	4'-2"	
502	62	4'-1"	
#5V	62	8'-1"	
#5H	24	29'-8"	
TOTAL #5			1665 LBS.
#4	31	7'-8"	
TOTAL #4			159 LBS.
TOTAL EPOXY-COATED REINFORCING BARS			1824 LBS.
CONCRETE, CLASS "A"			34.9 CYS
SURFACE SEAL			28.3 SYS



501 x 4'-2"



502 x 4'-1"

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
SPREAD FOUNDATIONS
BILLS OF MATERIALS
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-04

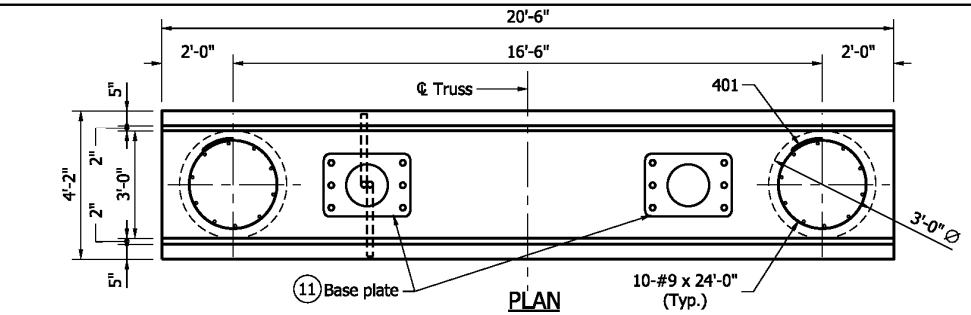
DESIGN STANDARDS ENGINEER

DESIGN STANDARDS ENGINEER DATE

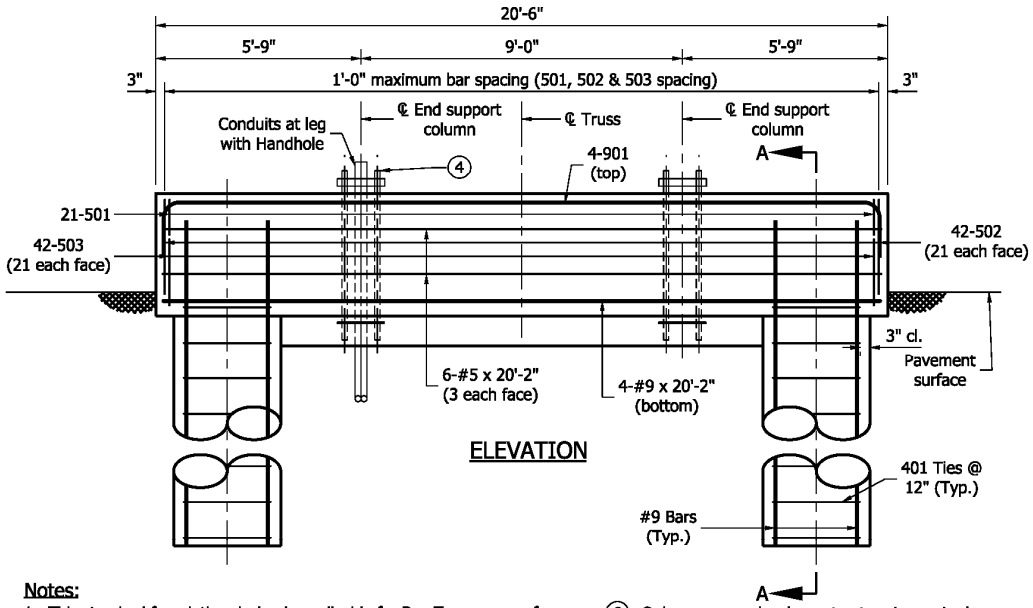
CHIEF HIGHWAY ENGINEER DATE

REVISION TO THE STANDARD DRAWINGS

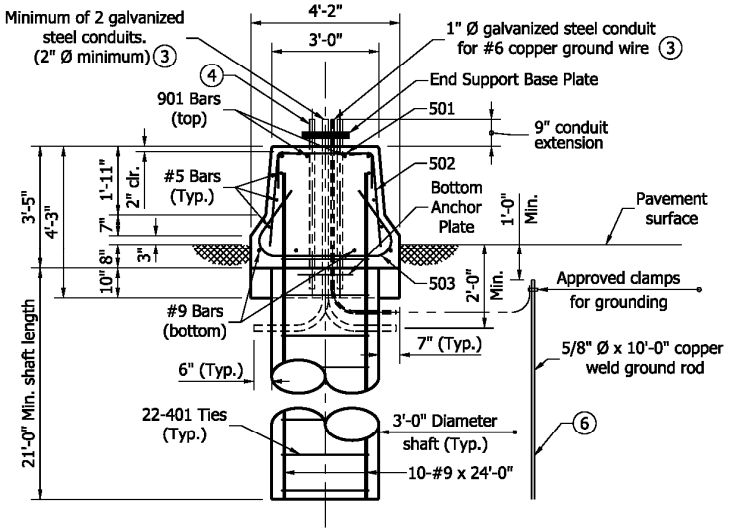
802-BTSF-05 BOX TRUSS STRUCTURE FOUNDATION DRILLED SHAFT FOUNDATION AT 33" CONCRETE BARRIER (PROPOSED NEW DRAWING)



PLAN



ELEVATION



SECTION A-A

Legend:
H = Horizontal Bar
V = Vertical Bar

Notes:

1. This standard foundation design is applicable for Box Truss spans of 130' or less, truss mounting heights of 28'-6" or less and sign areas of 900 ft.² or less.
2. The design is based on clay soil with minimum unconfined shear strength of 750 psf or sand soil with minimum friction angle of 28 degrees.

3 Thread and cap both Ends of steel conduit.

4 See Standard Drawing E 802-SBTS-11 for anchor bolts details.

5. Surface seal top and sides of barrier railing to the Pavement surface.

6 Only one ground rod per structure is required.

7. All reinforcement to be epoxy coated.
8. See Standard Drawing E 602-CCMB-03 for concrete barrier width transition.
9. See Standard Drawing E 802-BTSF-08 for bill of materials and reinforcing bar bending details.
10. Top of foundation to be level.

11 See Standard Drawing E 802-SBTS-09 for base plate details.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
DRILLED SHAFT FOUNDATION
AT 33" CONCRETE BARRIER
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-05

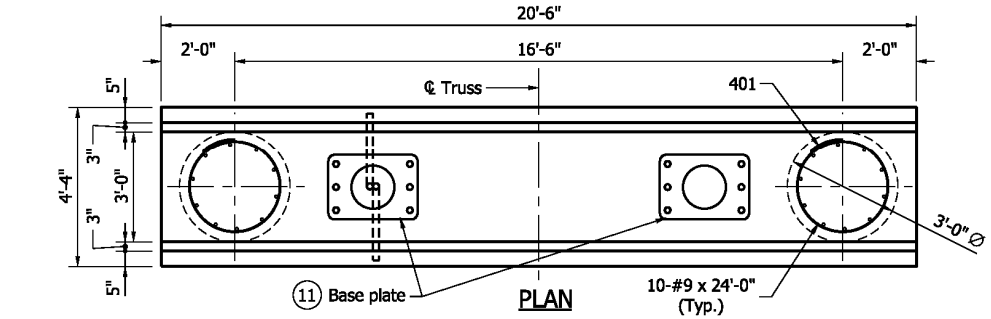
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

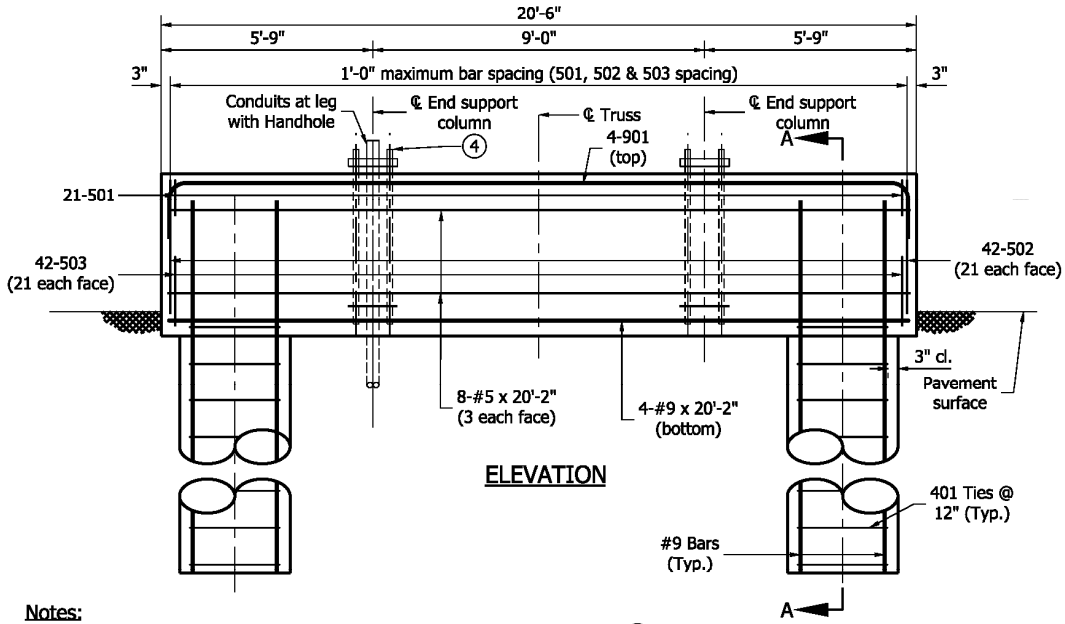
DESIGN STANDARDS ENGINEER

REVISION TO THE STANDARD DRAWINGS

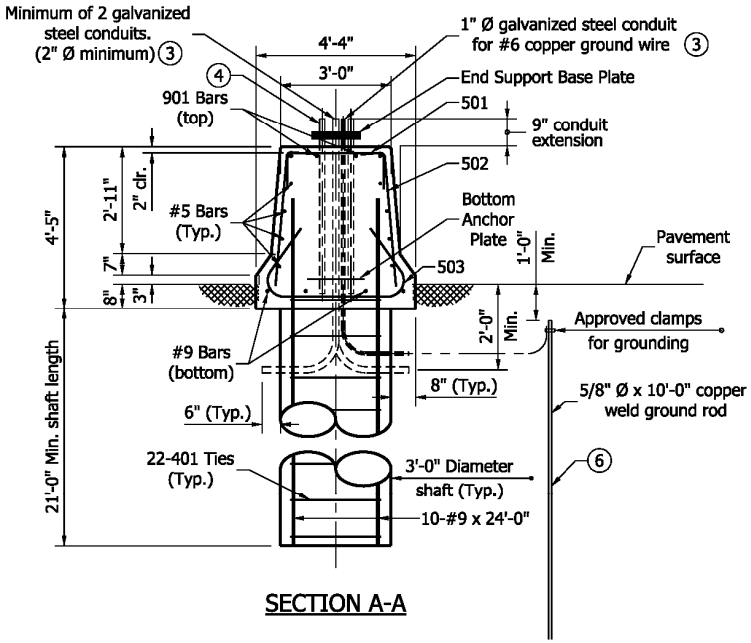
802-BTSF-06 BOX TRUSS STRUCTURE FOUNDATION DRILLED SHAFT FOUNDATION AT 45" CONCRETE BARRIER (PROPOSED NEW DRAWING)



PLAN



ELEVATION



SECTION A-A

Legend:
H = Horizontal Bar
V = Vertical Bar

Notes:

1. This standard foundation design is applicable for Box Truss spans of 130' or less, truss mounting heights of 28'-6" or less and sign areas of 900 ft.² or less.
2. The design is based on clay soil with minimum unconfined shear strength of 750 psf or sand soil with minimum friction angle of 28 degrees.

(3) Thread and cap both Ends of steel conduit.

(4) See Standard Drawing E 802-SBTS-11 for anchor bolts details.

5. Surface seal top and sides of barrier railing to the Pavement surface.

(6) Only one ground rod per structure is required.

7. All reinforcement to be epoxy coated.
8. See Standard Drawing E 602-CCMB-03 for concrete barrier width transition.
9. See Standard Drawing E 802-BTSF-08 for bill of materials and reinforcing bar bending details.
10. Top of foundation to be level.

(11) See Standard Drawing E 802-SBTS-09 for base plate details.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
DRILLED SHAFT FOUNDATION
AT 45" CONCRETE BARRIER
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-06

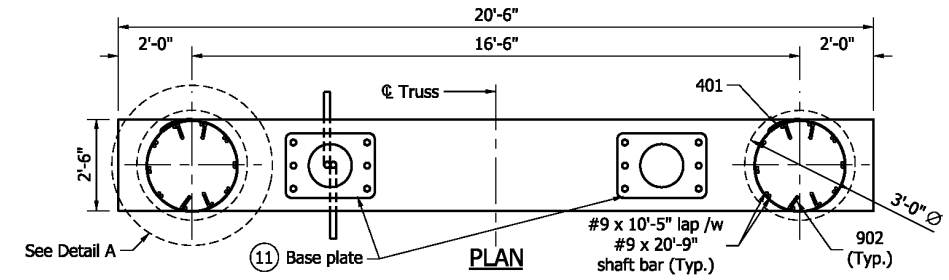
DESIGN STANDARDS ENGINEER

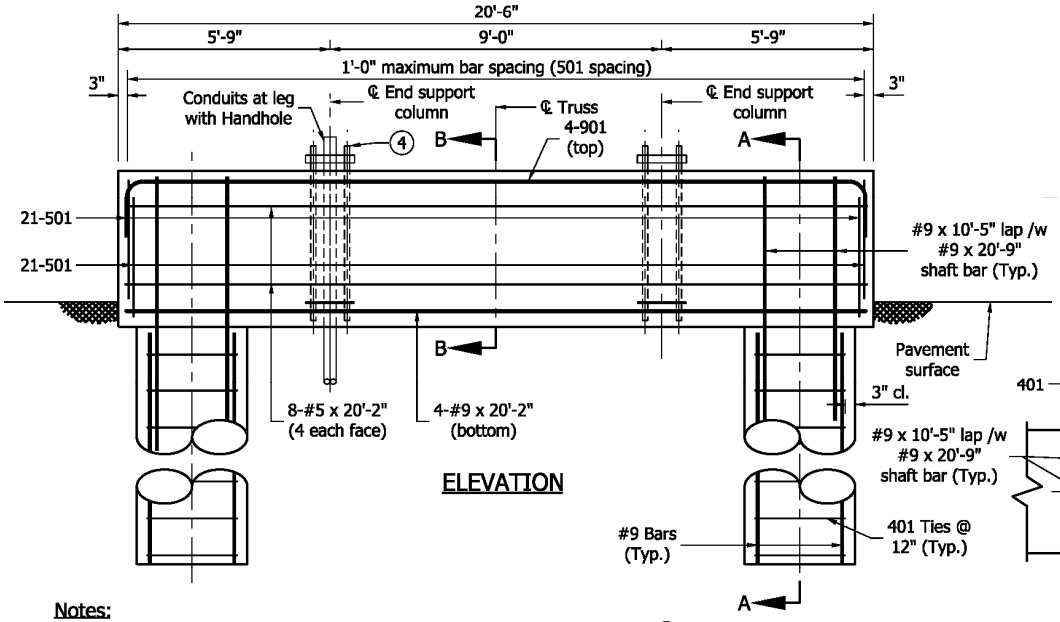
DESIGN STANDARDS ENGINEER DATE

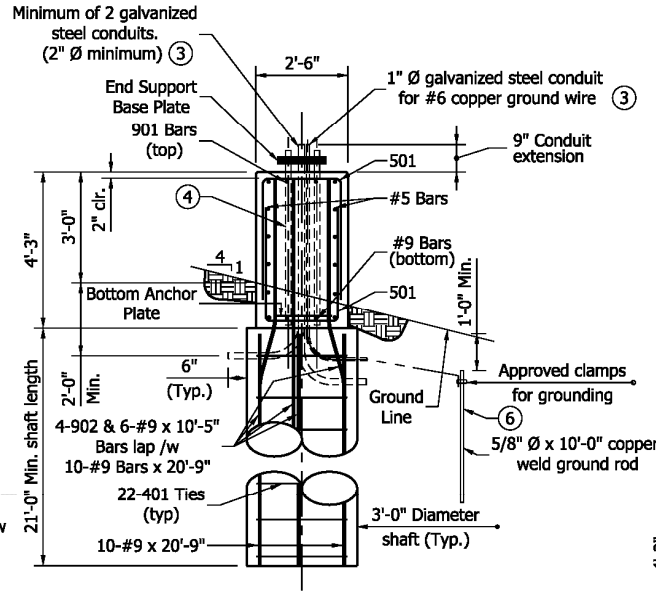
CHIEF HIGHWAY ENGINEER DATE

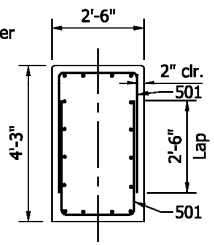
REVISION TO THE STANDARD DRAWINGS

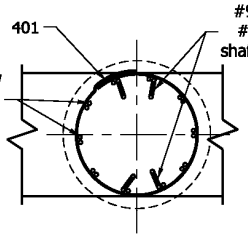
802-BTSF-07 BOX TRUSS STRUCTURE FOUNDATION DRILLED SHAFT FOUNDATION WITHOUT CONCRETE BARRIER (PROPOSED NEW DRAWING)











Legend:
H = Horizontal Bar
V = Vertical Bar

Notes:

1. This standard foundation design is applicable for Box Truss spans of 130' or less, truss mounting heights of 28'-6" or less and sign areas of 900 sq. ft. or less.
2. The design is based on clay soil with minimum unconfined shear strength of 750 psf or sand soil with minimum friction angle of 28 degrees.
3. Thread and cap both Ends of steel conduit.
4. See Standard Drawing E 802-SBTS-11 for anchor bolts details.
5. Surface seal top and sides of barrier railing to the Pavement surface.
6. Only one ground rod per structure is required.
7. All reinforcement to be epoxy coated.
8. See Standard Drawing E 602-CCMB-03 for concrete barrier width transition.
9. See Standard Drawing E 802-BTSF-08 for bill of materials and reinforcing bar bending details.
10. Top of foundation to be level.
11. See Standard Drawing E 802-SBTS-09 for base plate details.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
DRILLED SHAFT FOUNDATION
WITHOUT CONCRET BARRIER
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-07

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

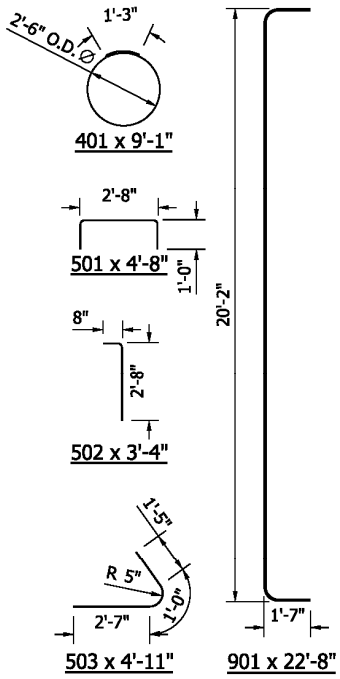
REVISION TO THE STANDARD DRAWINGS

802-BTSF-08 BOX TRUSS STRUCTURE FOUNDATION DRILLED SHAFT FOUNDATION BILLS OF MATERIALS (PROPOSED NEW DRAWING)

DRILLED SHAFT FOUNDATION AT 33" HEIGHT CONCRETE BARRIER WALL

EPOXY-COATED REINFORCING BARS

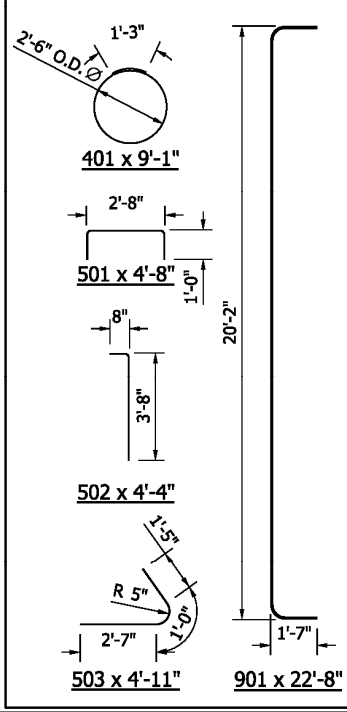
SIZE & MARK	NO. OF BARS	LENGTH	WEIGHT
401	44	9'-1"	
TOTAL #4			267 LBS.
501	21	4'-8"	
502	42	3'-4"	
503	42	4'-11"	
#5	6	20'-2"	
TOTAL #5			590 LBS.
901	4	23'-4"	
#9	4	20'-2"	
#9	20	24'-0"	
TOTAL #9			2224 LBS.
TOTAL EPOXY-COATED REINFORCING BARS			3081 LBS.
CONCRETE, CLASS "A"			21.9 CYS.
SURFACE SEAL			20.0 SYS.



DRILLED SHAFT FOUNDATION AT 45" HEIGHT CONCRETE BARRIER WALL

EPOXY-COATED REINFORCING BARS

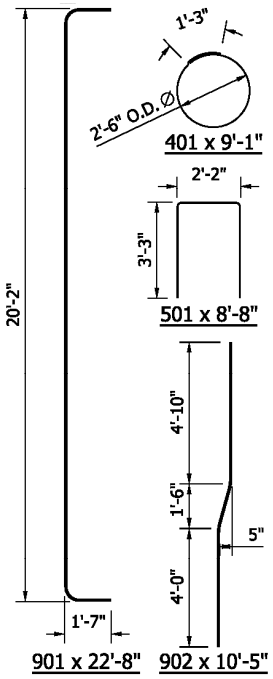
SIZE & MARK	NO. OF BARS	LENGTH	WEIGHT
401	44	9'-1"	
TOTAL #4			267 LBS.
501	21	4'-8"	
502	42	4'-4"	
503	42	4'-11"	
#5	8	20'-2"	
TOTAL #5			676 LBS.
901	4	23'-4"	
#9	4	20'-2"	
#9	20	24'-0"	
TOTAL #9			2224 LBS.
TOTAL EPOXY-COATED REINFORCING BARS			3167 LBS.
CONCRETE, CLASS "A"			22.9 CYS.
SURFACE SEAL			24.6 SYS.



DRILLED SHAFT FOUNDATION WITHOUT BARRIER WALL

EPOXY-COATED REINFORCING BARS

SIZE & MARK	NO. OF BARS	LENGTH	WEIGHT
401	44	9'-1"	
TOTAL #4			267 LBS.
501	42	8'-8"	
#5	8	20'-2"	
TOTAL #5			526 LBS.
901	4	23'-4"	
902	10	10'-5"	
#9	4	20'-2"	
#9	10	10'-5"	
#9	20	20'-9"	
TOTAL #9			2754 LBS.
TOTAL EPOXY-COATED REINFORCING BARS			3547 LBS.
CONCRETE, CLASS "A"			17.4 CYS.
SURFACE SEAL			18.2 SYS.



NOTES:

1. See Standard Drawing E 802-BTSF-05 for drilled shaft foundation at 33" height concrete barrier.
2. See Standard Drawing E 802-BTSF-06 for drilled shaft foundation at 45" height concrete barrier.
3. See Standard Drawing E 802-BTSF-07 for drilled shaft foundation without concrete barrier wall.
4. Each bill of materials is for one foundation size and type.
5. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending requirements.

INDIANA DEPARTMENT OF TRANSPORTATION

BOX TRUSS STRUCTURE FOUNDATION
DRILLED SHAFT FOUNDATIONS
BILLS OF MATERIALS
JUNE 2009

STANDARD DRAWING NO. E 802-BTSF-08

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

Item No. 02 12/17/09 (2010 SS)
Mr. Wright
Date: 12/17/09

COMMENTS AND ACTION

802-SBTS-01 THRU 08 SIGN BOX TRUSS STRUCTURE (various)
802-SBTS-08A SIGN BOX TRUSS STRUCTURE END SUPPORT
802-BTSF-01 THRU 08 BOX TRUSS STRUCTURE FOUNDATION (various)

Motion: Second: Ayes: Nays: Other sections containing specific cross references: None Recurring Special Provision affected: None Standard Sheets affected: E802-SNWW-01 E802-SNWW-02 E802-SNWW-03 E802-SNWW-04 E802-SNWW-05 E802-SNWW-06 GIFE Sections affected: None	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn _____ 20__ Standard Specifications Book _____ Create RSP (No._____) Effective _____Letting RSP Sunset Date: _____ _____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____ Standard Drawing Effective _____ _____ Create RPD (No. _____) Effective _____Letting _____ Technical Advisory GIFE Update Req'd.? Y _____ N _____ By _____ Addition or _____ Revision Frequency Manual Update Req'd? Y___N___ By _____ Addition or _____ Revision Received FHWA Approval? _____

Mr. Walker
Date: 12/17/09

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The following items require revisions to sections 401, 402, and 410

1. Recycled Materials (401, 402, 410) - Because of the variable amount of binder in Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS), the amount of RAP, RAS, or blend of the RAP and RAS should be determined by the amount of binder replacement in the HMA mixture rather than allowing a percentage of each of these materials in HMA. A table has been added that indicates the maximum binder replacement allowed for dense graded and open graded base and intermediate mixtures and for dense graded surface mixtures.

The RAP study conducted by the SuperPave Center and the study by Materials Management on RAP from 33 plants in 5 Districts has indicated that 25% or less binder replacement to HMA mixtures may be made without a change in grade of the PG binder. Also, the studies indicated that greater than 25% and equal to or less than 40% binder replacement to the HMA mixture is acceptable if the upper and lower temperature classifications of the binder are reduced by 6^{o} C from the specified binder.

Post-consumer (tear-off) shingles have successfully been included in HMA mixtures on two INDOT projects in 2009 and Materials Management is currently participating in the National Pooled Fund Study on RAS. AASHTO MP 15 is the specification that covers adding RAS to HMA mixtures and also specifies the allowable percentage of deleterious materials in the RAS. An IDEM Legitimate Use Approval letter is required to be submitted to the Engineer prior to use. A limit of the amount of binder replacement of the shingles in the HMA mixture is recommended until the National Study on RAS is completed.

Revisions to 402 for recycled materials are the same as revisions to 401 except that open-graded mixtures are not included in 402 and the mixture Categories are A, B, C. and D instead of mixture categories 1-5.

Revisions to 410 are the same as 401 except the changes pertain only to SMA mixtures.

2. 4.75 mm mixture (402.04) - The 4.75 mm mixture was successfully placed on several contracts in 2009 and should be included as an option for Type A, B, C, and D surface mixtures.

3. Temporary HMA Mixtures (402.07) - There has been a problem with the contract plans indicating a type of 402 mixture that was different than the Standard Specifications requirement for Temporary HMA Mixtures. This revision will allow the designers to specify a type of mixture for Temporary HMA Mixtures.

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS (CONTINUED)

PROPOSED SOLUTION: The following revisions are recommended to be authorized and made effective by a Recurring Special Provision.

1. Include provisions to require the binder replacement of recycled materials in HMA mixtures
2. Include provisions to designate the amount of binder replacement in 401, 402, and 410.
3. Allow post-consumer shingles in HMA mixtures and limit the binder replacement to 25%
4. Allow 4.75 mm mixture as an option for 402 Type A, B, C, and D surface mixtures
5. Allow designers to specify the type of mixture for temporary HMA mixtures.

APPLICABLE STANDARD SPECIFICATIONS: 401, 402, and 410

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE: Section 13

APPLICABLE RECURRING SPECIAL PROVISIONS: 400-R-553

Submitted By: Ron Walker

Title: Manager, Office of Materials Management

Organization: INDOT

Phone Number: 317-610-7251 x 204

Date: 11-25-09

APPLICABLE SUB-COMMITTEE ENDORSEMENT? These specifications are recommended by the INDOT/APAI Technical Committee

Item No. 03 12/17/09 (2010 SS)
Mr. Walker
Date: 12/17/09

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.06 RECYCLED MATERIALS

SECTION 401, BEGIN LINE 118, DELETE AND INSERT AS FOLLOWS:

401.06 Recycled Materials

~~Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility No tear-off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials. The coarse aggregate in the recycled materials shall pass the maximum size sieve for the mixture being produced~~.

~~Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. When only RAP is used in the mixture, the RAP shall not exceed 25.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 5.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the DMF.~~

~~A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in ESAL category 3, 4, or 5 surface mixtures and open graded mixtures. The recycled material for the ESAL category 3, 4, or 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.~~

~~The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 401.05.~~

~~Mixtures containing 15.0% or less RAP shall use the same grade of binder as specified. The binder for mixtures containing greater than 15.0% and up to 25.0% RAP shall be reduced by one temperature classification, 6°C, for both the upper and lower temperature classifications.~~

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced and the RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve. RAP for the ESAL category 3, 4 and 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.

Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. The amount of total binder replaced by binder in the recycled material shall be computed as follows:

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.06 RECYCLED MATERIAL (CONTINUED)

$$Binder\ Replacement, \% = \frac{(A\ x\ B) + (C\ x\ D)}{E}\ x\ 100\%$$

where:

A = RAP, % Binder Content
B = RAP, % in Mixture
C = RAS, % Binder Content
D = RAS, % in Mixture
E = Total, % Binder Content in Mixture

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles. Post-consumer asphalt shingles shall be in accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer asphalt shingles shall not be blended for use in HMA mixtures and shall be stockpiled separately from other materials.

The recycled material percentages shall be as specified on the DMF. HMA mixtures utilizing recycled materials shall be limited to the binder replacement percentages in the following table:

HMA mixtures utilizing RAP or RAS or a blend of RAP and RAS

Maximum Binder Replacement, %								
Mixture Category	*Base and Intermediate*					*Surface*		
	Dense Graded			*Open Graded*		*Dense Graded*		
	25.0 mm	*19.0 mm*	*12.5 mm*	*25.0 mm*	*19.0 mm*	*12.5 mm*	*9.5 mm*	*4.75 mm*
1	*40.0*			*25.0*		*40.0*		
2	*40.0*			*25.0*		*40.0*		
3	*40.0*			*25.0*		*15.0*		
4	*40.0*			*25.0*		*15.0*		
5	*40.0*			*25.0*		*15.0*		

The combined aggregate properties shall be in accordance with 904. The combined aggregate bulk specific gravity shall be determined in accordance with ITM 584 and the combined aggregate gradation shall be in accordance with 401.05 for the HMA mixture specified.

HMA mixtures with a binder replacement less than or equal to 25.0% by weight (mass) of the total binder content by utilizing RAP or RAS or a blend of RAP and RAS materials shall use the specified binder grade.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 401.06 RECYCLED MATERIAL (CONTINUED)

HMA mixtures with a binder replacement greater than 25.0% and less than or equal to 40.0% by weight (mass) of the total binder content by utilizing RAP or a blend of RAP and RAS shall use a binder grade with upper and lower temperature classifications reduced by 6°C from the specified binder grade. RAS materials shall not contribute more than 25.0% by weight (mass) of the total binder content for any HMA mixture.

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 402 HOT MIX ASPHALT, HMA, PAVEMENT

SECTION 402, BEGIN LINE 18, DELETE AS FOLLOWS:

402.03 Materials

Materials shall be in accordance with the following:

Asphalt Materials
PG Binder~~, PG 58-28*, PG 64-22, PG 64-28*, PG 70-22, PG 76-22~~ .....902.01(a)
Coarse Aggregates 904
Base Mixtures, – Class D or Higher
Intermediate Mixtures – Class C or Higher
** Surface Mixtures – Class B or Higher*
Fine Aggregates 904
~~* Only for use in mixtures containing greater than 15% RAP. Refer to 402.05.~~
** Surface aggregate requirements are listed in 904.03(d).

SECTION 402, BEGIN LINE 39, INSERT AS FOLLOWS:

Mixture Type	Type A	Type B	Type C	Type D
Design ESAL	200,000	2,000,000	9,000,000	11,000,000
Surface	*4.75 mm*	*4.75 mm*	*4.75 mm*	*4.75 mm*
	9.5 mm	9.5 mm	9.5 mm	9.5 mm
	12.5 mm	12.5 mm	12.5 mm	12.5 mm
Surface – PG Binder	64-22	64-22	70-22	70-22
Intermediate	12.5 mm	12.5 mm	12.5 mm	12.5 mm
	19.0 mm	19.0 mm	19.0 mm	19.0 mm
Intermediate – PG Binder	64-22	64-22	64-22	70-22
Base	19.0 mm	19.0 mm	19.0 mm	19.0 mm
	25.0 mm	25.0 mm	25.0 mm	25.0 mm
Base – PG Binder	64-22	64-22	64-22	64-22

SECTION 402, BEGIN LINE 102, DELETE AND INSERT AS FOLLOWS:

402.08 Recycled Materials

~~Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear-off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials. The coarse aggregate in the recycled materials shall pass the maximum size sieve for the mixture being produced.~~

~~Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. When only RAP is used in the mixture, the RAP shall not exceed 25.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 5.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is~~

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 402 HOT MIX ASPHALT, HMA, PAVEMENT (CONTINUED)

~~considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the JMF.~~

~~A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in type C and D surface mixtures provided the recycled material is 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve.~~

~~The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 402.03.~~

~~Mixtures containing 15.0% or less RAP shall use the same grade of binder as specified. The binder for mixtures containing greater than 15.0% and up to 25.0% RAP shall be reduced by one temperature classification, 6°C, for both the upper and lower temperature classifications.~~

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced and the RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve. RAP for the type C and D surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.

Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. The amount of total binder replaced by binder in the recycled material shall be computed as follows:

$$Binder\ Replacement,\% = \frac{(A\ x\ B) + (C\ x\ D)}{E}\ x\ 100\%$$

where:

A = RAP, % Binder Content
B = RAP, % in Mixture
C = RAS, % Binder Content
D = RAS, % in Mixture
E = Total, % Binder Content in Mixture

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles. Post-consumer asphalt shingles shall be in accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 402 HOT MIX ASPHALT, HMA, PAVEMENT (CONTINUED)

asphalt shingles shall not be blended for use in HMA mixtures and shall be stockpiled separately from other materials.

The recycled material percentages shall be as specified on the DMF. HMA mixtures utilizing recycled materials shall be limited to the binder replacement percentages in the following table:

HMA mixtures utilizing RAP or RAS or a blend of RAP and RAS

Maximum Binder Replacement, %						
Mixture Category	*Base and Intermediate*			*Surface*		
	Dense Graded			*Dense Graded*		
	25.0 mm	*19.0 mm*	*12.5 mm*	*12.5 mm*	*9.5 mm*	*4.75 mm*
A	*40.0*			*40.0*		
B	*40.0*			*40.0*		
C	*40.0*			*15.0*		
D	*40.0*			*15.0*		

The combined aggregate properties shall be in accordance with 904. The combined aggregate bulk specific gravity shall be determined in accordance with ITM 584 and the combined aggregate gradation shall be in accordance with 401.05 for the HMA mixture specified.

HMA mixtures with a binder replacement less than or equal to 25.0% by weight (mass) of the total binder content by utilizing RAP or RAS or a blend of RAP and RAS materials shall use the specified binder grade.

HMA mixtures with a binder replacement greater than 25.0% and less than or equal to 40.0% by weight (mass) of the total binder content by utilizing RAP or a blend of RAP and RAS shall use a binder grade with upper and lower temperature classifications reduced by 6°C from the specified binder grade. RAS materials shall not contribute more than 25.0% by weight (mass) of the total binder content for any HMA mixture.

SECTION 402, BEGIN LINE 87, DELETE AND INSERT AS FOLLOWS:

(c) Composition Limits for Temporary HMA Mixtures

Temporary HMA mixtures shall be *the* type ~~B~~ *specified* in accordance with 402.04. A MAF in accordance with 402.05 will not apply.

SECTION 402, BEGIN LINE 392, INSERT AS FOLLOWS:

HMA for Temporary Pavement*, Type* __*__ ..... TON (Mg)

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 410.06 RECYCLED MATERIALS

SECTION 410, BEGIN LINE 93, DELETE AND INSERT AS FOLLOWS:

410.06 Recycled Materials

~~Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The recycled material shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear-off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials.~~

~~Recycled materials may be used as a substitute for a portion of the new materials required to produce mainline surface. When only RAP is used in the mixture, the RAP shall not exceed 15.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not *exceed* 3.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the DMF.~~

~~The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 410.05.~~

~~Mixtures containing RAP shall use the same grade of binder as specified~~.

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced and the RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve. RAP for the ESAL category 3, 4 and 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.

Recycled materials may be used as a substitute for a portion of the new materials required to produce SMA mixtures. The amount of total binder replaced by binder in the recycled material shall be computed as follows:

$$Binder\ Replacement, \% = \frac{(A\ x\ B) + (C\ x\ D)}{E}\ x\ 100\%$$

where:

A = RAP, % Binder Content
B = RAP, % in Mixture
C = RAS, % Binder Content
D = RAS, % in Mixture
E = Total, % Binder Content in Mixture

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 410.06 RECYCLED MATERIALS (CONTINUED)

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles. Post-consumer asphalt shingles shall be in accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer asphalt shingles shall not be blended for use in SMA mixtures and shall be stockpiled separately from other materials.

The recycled material percentages shall be as specified on the DMF. SMA mixtures utilizing recycled materials shall be limited to the binder replacement percentages in the following table:

SMA mixtures utilizing RAP or RAS or a blend of RAP and RAS

Maximum Binder Replacement, %		
	SMA Surface	
Mixture Category	*12.5 mm*	*9.5 mm*
1	*40.0*	*40.0*
2	*40.0*	*40.0*
3	*15.0*	*15.0*
4	*15.0*	*15.0*
5	*15.0*	*15.0*

The combined aggregate properties shall be in accordance with 904. The combined aggregate bulk specific gravity shall be determined in accordance with ITM 584 and the combined aggregate gradation shall be in accordance with 401.05 for the SMA mixture specified.

SMA mixtures with a binder replacement less than or equal to 25.0% by weight (mass) of the total binder content by utilizing RAP or RAS or a blend of RAP and RAS materials shall use the specified binder grade.

SMA mixtures with a binder replacement greater than 25.0% and less than or equal to 40.0% by weight (mass) of the total binder content by utilizing RAP or a blend of RAP and RAS shall use a binder grade with upper and lower temperature classifications reduced by 6^{o} C from the specified binder grade. RAS materials shall not contribute more than 25.0% by weight (mass) of the total binder content for any SMA mixture.

COMMENTS AND ACTIONS

REVISION TO SECTION 401.06 RECYCLED MATERIALS
REVISION TO SECTION 402 HOT MIX ASPHALT, HMA, PAVEMENT
REVISION TO SECTION 410.06 RECYCLED MATERIALS

Motion: Second: Ayes: Nays: Other sections containing specific cross references: Section 401.06 and 410.06 with: 904.01 Pg. 768 Section 402 with: 304.05 Pg.218; 305.01 Pg.219 503.03 Pg.320 507.08 Pg.339 604.09 Pg.367 610.02 Pg.384 610.06 Pg.385 713.05 Pg.574 715.13 Pg.591 Recurring Special Provision affected: 109-C-219 400-R-553 400-R-565 922-T-168 Standard Sheets affected: None GIFE Sections affected: Section 13	Action: ____ Passed as Submitted ____ Passed as Revised ____ Withdrawn ____ 20__ Standard Specifications Book ____ Create RSP (No.____) Effective ____Letting RSP Sunset Date: ____ ____ Revise RSP (No.____) Effective ____Letting RSP Sunset Date: ____ Standard Drawing Effective ____ ____ Create RPD (No. ____) Effective ____Letting ____ Technical Advisory GIFE Update Req'd.? Y ____ N ____ By ____ Addition or ____ Revision Frequency Manual Update Req'd? Y__N__ By ____ Addition or ____ Revision Received FHWA Approval? ____