INDIANA DEPARTMENT OF TRANSPORTATION

STANDARDS COMMITTEE MEETING

Driving Indiana's Economic Growth

APPROVED MINUTES

January 21, 2010 Standards Committee Meeting

(Changes to the Final Draft Minutes by Action of the Committee on March 18, 2010 shown as Highlighted in Yellow)

MEMORANDUM

March 29, 2010

TO: Standards Committee

FROM: Greg Broz, Secretary

RE: Minutes for the January 21, 2010 Standards Committee Meeting

The Standards Committee meeting was called to order by the Chairman at 9:04 a.m. on January 21 , 20 10 in the N 955 Bay Window Conference Room. The meeting was adjourned at 12:18 p.m.

The following committee members were in attendance:

Mark Miller, Chairman	Dave Andrewski, Pvmt. Engineering
Greg Pankow, Constr. Mgmt.	Bob Cales, Contract Admin.
John Wright, Roadway Services	Todd Shields, Highway Operations
Anne Rearick, Structural Services	Ron Walker, Materials Mgmt.
Jim Keefer, Fort Wayne Dist.	Tom Caplinger, Crawfordsville Dist.

Also in attendance were the following:

Greg Broz, Secretary	Steve Fisher, BITS
Dana Plattner, INDOT	Kenny Anderson, INDOT-OMM
Bren George, FHWA	Eric Carleton, Independent Pipe Co.
Jim Reilman, INDOT Constr. Mgmt.	Joe Rogers, ADS Pipe
Paul Berebitsky, ICA	Joe Fisher, CONTECH Constr. Prod.
Tony Uremovich, INDOT Struct. Serv.	PJ Hewitt, CONTECH Constr. Prod
Steve Apple, Indiana Sign & Barr.	Doug Witten, CONTECH Constr. Prod.
Ting Nahrwold, INDOT, Hghw. Maint.	Eric Wathen, Rinker Materials
Peter Carleton, INDOT	Tom Rueschhoff, INDOT

The following items were considered:

Page No.

A. GENERAL BUSINESS ITEMS

OLD BUSINESS

(No items considered)

NEW BUSINESS

1. Approval of the December 17, 2009 Minutes

ACTION: Approved as Submitted

Motion: Mr. Cales
Second: Mr. Andrewski
Ayes: 8
Nays: 0

B. CONCEPTUAL PROPOSAL ITEMS

OLD BUSINESS

(No items considered)

NEW BUSINESS

(No items considered)

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

OLD BUSINESS

		Page No.
Item No. 01 10/15/09 (2010 SS)	Mr. Shields	5
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	
ACTION:	Passed as ~~Submitted~~ ***Revised*** (See comments on page 61)	

Item No. 01 11/19/09 (2010 SS)	Mr. Walker	62
715.02	Materials	
715.09	Backfilling	
715.13	Method of Measurement	
715.14	Basis of Payment	
716.02	Materials	
718.02	Materials	
907(907.16 thru 907.27)	CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS (various sections)	
908.14	Slotted Drain or Sl otted Vane Drain Pipe	
ACTION:	Passed as Revised	

NEW BUSINESS

Item No. 01 01/21/10 (2010 SS)	Mr. Wright	78
207.04	Subgrade Treatment	
207.06	Basis of Payment	
IDM 51-7.06	Pavement Section	
Standard Drawings:		

(Continued) Page No.

	E402-NVUF-01	*HMA TYPICAL SECTION*
	E402-NVUF-02	*HMA TYPICAL SECTION (For shared-Use Paths on Abandoned Railroad Corridors)*
	E502-NVUF-01	*PCCP TYPICAL SECTION*
ACTION:		Passed as Revised
Item No. 02 01/21/10 (2010 SS)		Mr.Heustis 87
	RSP XXX-X-XXX	*INCIDENT MANAGEMENT COOPERATION*
ACTION:		Withdrawn
Item No. 03 01/21/10 (2010 SS)		Mr.Heustis 92
	RSP XXX-X-XXX	*WRECKER SERVICE*
ACTION:		Withdrawn
Item No. 04 01/21/10 (2010 SS)		Mr.Andrewski 98
	Standard Drawings:	
	E 610-PRAP-02	PUBLIC ROAD APPROACH TYPE A
	E 610-PRAP-03	PUBLIC ROAD APPROACH TYPE B
	E 610-PRAP-04	PUBLIC ROAD APPROACH TYPE A & B - GENERAL NOTES
	E 610-PRAP-05	PUBLIC ROAD APPROACH TYPE A & TYPE B - TABLE OF VALUE
	E 610-PRAP-06	PUBLIC ROAD APPROACH TYPE C
	E 610-PRAP-07	PUBLIC ROAD APPROACH PAY LIMITS
	E 610-PRAP-08	PUBLIC ROAD APPROACH TYPE C - GENERAL NOTES
	E 610-PRAP-09	PUBLIC ROAD APPROACH TYPE C - TABLE OF VALUES
	E 610-PRAP-10	PUBLIC ROAD APPROACH TYPE D
	E 610-PRAP-11	PUBLIC ROAD APPROACH TYPE D GENERAL NOTES AND TABLE A
	E 610-PRAP-12	PUBLIC ROAD APPROACH TYPE D - TABLE OF VALUES
	E 713 TCTR-04	TEMPORARY RUNAROUNDS GENERAL NOTES
	IDM 82-6.04	Runaround or Detour
ACTION:		Passed as Revised
Item No. 05 01/21/10 (2010 SS)		Mr.Andrewski 114
	IDM FIGURE 52-13F	PCCP SECTION WITH PCC SHOULDER
	IDM FIGURE 52-13G	PCCP SECTION WITH HMA SHOULDER
	IDM FIGURE 52-13H	PCCP WITH CONCRETE CURB
	IDM FIGURE 52-13P	PCCP WITH UNDERDRAIN
	IDM FIGURE 52-13T	PCCP RAMP
ACTION:		Withdrawn
Item No. 06 01/21/10 (2010 SS)		Mr.Andrewski 127
	503.03(a)	Type D-1 Contraction Joint
	Standard Drawing:	
	E 503-CCPJ-01	TYPE D-1 CONTRACTION JOINT
ACTION:		~~Passed as Submitted~~ *Withdrawn (See comments on page 130)*
Item No. 07 01/21/10 (2010 SS)		Mr.Wright 131
	Standard Drawing:	
	E 614-RRGC-01	*RAILROAD CROSSING DETAILS HMA HEADER*
	E 614-RRGC-02	*RAILROAD CROSSING DETAILS RC HEADER*

(Continued)

E 614-RRGC-03	*RAILROAD CROSSING DETAILS HMA INTER TRACK HEADER*
E 614-RRGC-04	*RAILROAD CROSSING DETAILS RC INTER TRACK HEADER*
E 614-RRGC-05	*RAILROAD CROSSING DETAILS CROWN-OUT DIAGRAM*
ACTION:	Withdrawn

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

SPECIFICATION REVISIONS (OLD BUSINESS ITEM)

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: December 22, 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)

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

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 (OLD BUSINESS ITEM)

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.*

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. 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.

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* contracts *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.*

~~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, after which removal and replacement of the markings will be required.

(b) Durable Pavement Marking Material

Durable pavement marking material consists of thermoplastic, preformed plastic, or ~~epoxy~~ *multi-component markings.*

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* temperatures ~~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 markings.

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* temperatures ~~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, after which removal and replacement of the markings will be required.

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.

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.

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.~~ 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.~~ 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 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. Retro-reflectivity testing will be waived for markings applied after October 31 and before April 1. 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 0.70 of the required minimum level, per 808.07(c).

~~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**
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 *removal and or* replacement of markings that fail to meet the *performance or* warranty conditions of *808.07 and* 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.~~

~~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.

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 808 - PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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

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.

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 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	Match the strong limits	± 6.00
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 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 STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

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 *solid form in* accordance with AASHTO M 249 *or supplied in a preformed state and shall not contain lead chromate pigments*.

Heat bonded preformed thermoplastic shall be in accordance with AASHTO M 249 with the exception of the application properties 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.*

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.~~

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. 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.~~

~~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.

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.~~

~~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.~~

~~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*

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 (OLD BUSINESS ITEM)

REVISION TO IDM 76-3.0 PAVEMENT MARKING MATERIALS, INCLUDING FIGURE 76-3A PAVEMENT MARKINGS APPLICATIONS

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~~*35* 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.

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.

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 in 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 (OLD BUSINESS ITEM)

REVISION TO IDM 76-3.0 PAVEMENT MARKING MATERIALS, INCLUDING FIGURE 76-3A PAVEMENT MARKINGS APPLICATIONS (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.

REVISION TO ITM No.931-08T MEASUREMENT OF RETROREFLECTIVE PAVEMENT MARKING MATERIALS (CONTINUED)

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

Average $(\bar{x})$

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

Standard Deviation (s):

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

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

where:

n = the number of measurements within each measurement sampling zone

sampling zone, segment, and section as follows:

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 (OLD BUSINESS ITEM)

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 (OLD BUSINESS ITEM)

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

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 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 (OLD BUSINESS ITEM)

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 76-3.0 PAVEMENT MARKING MATERIALS, INCLUDING FIGURE 76-3A RECOMMENDED PAVEMENT MARKINGS APPLICATIONS
REVISION TO ITM No. 931-08T MEASUREMENT OF RETROREFLECTIVE PAVEMENT MARKING MATERIALS

Mr. Shields explained the changes that we re made to this item based on the comments that were received at the last standards committee meeting.

Mr. Berebitsky commented that since this was now a performance based specification, he hop ed that if there wer e late season issues that were to develop, INDOT would be open to making revisions to the specification.

This item was revised by the Standards Committee on March 18, 2010 such that 909.05 is to be reinstated. This allowed for miscellaneous paint items to have a specification referenc e and allow the Depa rtment to maintain a list of pre-approved paints.

Motion: Mr. Shields
Second: Mr. Cales
Ayes: 9
Nays: 0

Other sections containing specific cross references:

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

Section 808 with:
108.08 p.84; 604.04 p.366; 801.12 p.665,666; 801.14 p.667; 801.17 p.672;801.18 p.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:
~~ X ~~ Passed as Submitted
X Passed as Revised
____ Withdrawn

__X__ 2012 Standard Specifications Book
____ Create RSP (No.____)
Effective _____ Letting
RSP Sunset Date: ____

__X__ Revise RSP (No.808-R-551)
Effective September 01, 2010 Letting
RSP Sunset Date: ____

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

GIFE Update Req'd.? Y _X_ N ___

By ____ Addition or ____ Revision

Frequency Manual Update Req'd? Y__N_X_
By _____ Addition or _____ Revision
Received FHWA Approval?__X

SPECIFICATION REVISIONS (OLD BUSINESS ITEM)

REVISION TO STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Mandrel testing of thermoplastic pipes may not be being performed in accordance with the 715.09 specifications. Also the mandrel testing requirements in the specifications are not in accordance with AASHTO.
The Department desires to adjust the material requirements for plastic pipe.

PROPOSED SOLUTION: Modify the current 715 specification to more clearly identify the pipes that must be mandrel tested and the allowable deflections. Also make the specification in substantial compliance with AASHTO.
Revise the 907 materials section to address the new material requirements for plastic pipe.

APPLICABLE STANDARD SPECIFICATIONS: 715.02, 715.09, 715.13, 715.14, 716.02, 718.02, 907.16, 907.17, 907.18, 907.19, 907.20, 907.21, 907.22, 907.23, 907.24, 907.25, 907.26, 907.27, 908.14

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE: 4.11

APPLICABLE RECURRING SPECIAL PROVISIONS: Creation of an RSP for the 715 and 907 changes that is effective as soon as reasonably possible.

Submitted By: Ron Walker

Title: Manager, Office of Materials Management

Organization: INDOT

Phone Number: 610-7251

Date: 10/16/09

APPLICABLE SUB-COMMITTEE ENDORSEMENT? INDOT Pipe Committee

Item No. 01 11/19/09 (2010 SS)
Mr. Walker
Date: 01/21/10

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS

The Standard Specifications are revised as follows:

SECTION 715, BEGIN LINE 38, DELETE, AND INSERT AS FOLLOWS:

(a) Type 1 Pipe

Type 1 pipe shall be used for culverts under mainline pavement and public road approaches *and shall be in accordance with the following:*

Clay Pipe, Extra Strength.....907.08
Corrugated Aluminum Alloy Pipe and Pipe-Arches.....908.04
Corrugated Polyethylene Pipe, Type S .....~~907.19~~*
Corrugated Steel Pipe and Pipe-Arches 908.02
Non-Reinforced Concrete Pipe, Class 3.....907.01
Polymer Precoated Galvanized Corrugated Steel
Pipe and Pipe-Arches.....908.08
Profile Wall Polyvinyl Chloride Pipe .....~~907.22~~*
Reinforced Concrete Horizontal Elliptical Pipe.....907.03
Reinforced Concrete Pipe 907.02
Ribbed Polyethylene Pipe .....~~907.20~~*
Smooth Wall Polyethylene Pipe.....~~907.21~~*
Smooth Wall Polyvinyl Chloride Pipe.....~~907.23~~*
Structural Plate Pipe and Pipe-Arches 908.09

* *all thermoplastic pipe shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(b) Type 2 Pipe

Type 2 pipe shall be used for storm sewers *and shall be in accordance with the following:*

Clay Pipe, Extra Strength.....907.08
Corrugated Polyethylene Pipe, Type S .....~~907.19~~*
Fully Bituminous Coated and Lined Corrugated Steel
Pipe and Pipe-Arches.....908.13
Non-Reinforced Concrete Pipe, Class 3.....907.01
Polymer Precoated Galvanized Corrugated Steel
Pipe and Pipe-Arches.....908.08
Profile Wall Polyvinyl Chloride Pipe .....~~907.22~~*
Reinforced Concrete Horizontal Elliptical Pipe.....907.03
Reinforced Concrete Pipe 907.02
Ribbed Polyethylene Pipe .....~~907.20~~*
Smooth Wall Polyethylene Pipe.....~~907.21~~*
Smooth Wall Polyvinyl Chloride Pipe.....~~907.23~~*

* *all thermoplastic pipe shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(c) Type 3 Pipe

Type 3 pipe shall be used for culverts under all drives and field entrances. All Type 1 pipe materials are acceptable.

(d) Type 4 Pipe

Type 4 pipe shall be used for drain tile and longitudinal underdrains *and shall be in accordance with the following:*

Clay Pipe**	907.08
Corrugated Polyethylene Drainage Tubing	~~907.17~~*
Corrugated Polyethylene Pipe, Type S**	~~907.19~~*
Corrugated Polyethylene Pipe, Type SP	~~907.19~~*
Drain Tile**	907.11
Non-Reinforced Concrete Pipe	907.01
Perforated Clay Pipe**	907.09
Perforated Polyvinyl Chloride Semicircular Pipe	~~907.18~~*
Profile Wall Polyvinyl Chloride Pipe	~~907.22~~*

* *all thermoplastic pipe shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

** These materials shall be used for drain tiles only.

(e) Type 5 Pipe

Type 5 pipe shall be used for broken-back pipe runs where coupled or jointed pipe is desirable *and shall be in accordance with the following:*

Corrugated Aluminum Alloy Pipe and Pipe-Arches	908.04
Corrugated Polyethylene Pipe, Type S	~~907.19~~*
Corrugated Steel Pipe and Pipe-Arches	908.02
Fully Bituminous Coated and Lined Corrugated Steel Pipe and Pipe-Arches	908.13
Polymer Precoated Galvanized Corrugated Steel Pipe and Pipe-Arches	908.08
Profile Wall Polyvinyl Chloride Pipe	~~907.22~~*
Ribbed Polyethylene Pipe	~~907.20~~*
Smooth Wall Polyethylene Pipe	~~907.21~~*
Smooth Wall Polyvinyl Chloride Pipe	~~907.23~~*

* *all thermoplastic pipe shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(f) Slotted Drain Pipe

Slotted drain pipe shall be used to drain paved median and concrete gutter areas. Slotted drain pipe shall be in accordance with 908.14.

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS (CONTINUED)

(g) Slotted Vane Drain Pipe

Slotted vane drain pipe shall be used to drain driveway areas. Slotted vane drain pipe shall be ~~smooth wall polyvinyl chloride pipe~~ in accordance with ~~907.23~~ *908.14.* ~~The slotted vane drain casting shall be in accordance with 910.05(b). The finish shall be standard black asphalt emulsion. Individual units shall have a minimum weight (mass) of 155 lbs (70 kg).~~

(h) End Bent Drain Pipe

End bent drain pipe shall be perforated profile wall polyvinyl chloride pipe ~~in accordance with 907.22~~ or perforated smooth wall polyvinyl chloride pipe ~~in accordance with 907.23~~ *from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(i) Underdrain Outlet Pipe

Pipe shall be ~~in accordance with 907.22 or 907.24~~ *profile wall polyvinyl chloride pipe or smooth wall pipe for outlets from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

SECTION 715, BEGIN LINE 315, DELETE, AND INSERT AS FOLLOWS:

All pipes, except underdrains, will be visually inspected for acceptance a minimum of 30 days after the completion of backfill operations. Pipes that cannot be visually inspected shall be video inspected for acceptance in accordance with 718.07. The Engineer will determine the sections of pipe to be video inspected. *A copy of the video inspection shall be provided in a format acceptable to the Engineer prior to performing the mandrel testing.*

~~After the visual or video inspection, all polyethylene and smooth wall polyvinyl chloride pipes 36 in. (900 mm) or less in pipe pay item diameter shall be mandrel tested. The mandrel shall be a go/no go mandrel with a minimum of nine arms or prongs and a diameter of 5% less than the pipe pay item diameter. If the mandrel does not pass through the pipe when pulled by hand or the mandrel damages the pipe, the deficient pipe shall be removed, replaced, and mandrel tested a minimum of 30 days after the backfill has been replaced.~~

After the visual or video inspection, the Contractor shall check pipe deflection by performing a mandrel test for all pipes manufactured from materials listed in the following table or as otherwise directed.

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS (CONTINUED)

PIPES REQUIRED TO BE MANDREL TESTED			
Pipe Material	*INDOT Spec.*	*AASHTO Spec.*	*ASTM Spec.*
Corrugated Polyethylene Pipe	*907.19*	*M 294*	
Ribbed Polyethylene Pipe	*907.20*		*F 894*
Smooth Wall Polyethylene Pipe	*907.21*		*F 714*
*Profile Wall Polyvinyl Chloride Pipe**	*907.22*	*M 304*	
Smooth Wall Polyvinyl Chloride Pipe	*907.23*	*M 278*	*F 679*

**Mandrel testing will not be required for profile wall polyvinyl chloride pipe in accordance with 907.22 that also is in accordance with ASTM F 949.*

The mandrel shall have a minimum of nine arms or prongs and a diameter that is 95% of the nominal pipe ~~pay item~~ diameter. The Contractor shall provide a proving ring that is 95% of the nominal pipe ~~pay item~~ diameter for each mandrel.

The Contractor shall pull the mandrel through the pipe by hand. If the mandrel does not pass through the pipe, the Contractor shall measure and report the minimum diameter of the deficient pipe to the Engineer.

If the minimum diameter of the deficient pipe is between 92.5% and 95.0% of the nominal pipe ~~pay item~~ diameter, the contractor shall provide an evaluation of the deficient pipe done by a professional engineer. The evaluation shall consider the severity of the deflection and its effects on structural integrity, environmental conditions, and the design service life of the pipe. A report summarizing the evaluation and including the professional engineer's recommendation for acceptance, remediation, or replacement of the pipe shall be submitted to the Engineer for final determination.

If the minimum diameter of the deficient pipe is equal to or less than 92.5% of the nominal pipe diameter, the deficient pipe shall either be replaced or a remediation plan ~~for the deficient pipe done~~ shall be prepared by a professional engineer ~~shall be~~ and submitted to the Engineer for final determination.

The deficient pipe shall be replaced if the professional engineer's ~~report~~ remediation plan recommends replacement of the pipe or if the pipe has been damaged.~~:~~

~~*(a) The deflection of the pipe is greater than 7.5% of the pipe pay item diameter.*~~

~~*(b) The professional engineer's report recommends replacement of the pipe.*~~

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS (CONTINUED)

~~*(c) The mandrel has damaged the pipe.*~~

Deficient pipe shall at a minimum be replaced between the nearest pipe joints or to the nearest structure. ~~*Replacement*~~ *Replaced or remediated pipe sections shall be mandrel tested a minimum of 30 days after the completion of backfill operations.*

SECTION 715, BEGIN LINE 458, DELETE, AND INSERT AS FOLLOWS:

~~Mandrel testing of polyethylene and smooth wall polyvinyl chloride pipes 36 in. (900 mm) or less in pipe pay item diameter will not be measured for payment.~~

Geotextile used to wrap backfill material will not be measured for payment.

715.14 Basis of Payment

The accepted quantities of pipe will be paid for at the contract unit price per linear foot (meter) for pipe of the type, shape, and size specified, complete in place.

Pipe end sections, concrete anchors, and safety metal end sections will be paid for at the contract unit price per each for the size specified, complete in place. A concrete anchor attached at one end of twin pipes will be paid for as two concrete anchors. A concrete anchor attached at one end of triple pipes will be paid for as three concrete anchors. ~~Structure backfill will be paid for in accordance with 211.10. If utilized as a substitute for structure backfill or if used to backfill thermoplastic pipes fabricated of non-hydrostatic design basis resins, flowable backfill will be paid for as structure backfill. Otherwise, flowable backfill will be paid for in accordance with 213.09.~~

SECTION 715, BEGIN LINE 649, DELETE, AND INSERT AS FOLLOWS:

The cost of providing ~~the~~ video inspection equipment, technician, ~~videotapes, or computer disks~~*and a copy of the video inspection* shall be included in the cost of ~~the~~ video inspection for pipe. ~~No additional payment will be made for repair or removal of pipes, backfill, the video re-inspection of the repairs or replaced pipe, and all other work associated with the repair or removal of unaccepted pipes.~~

No additional payment will be made for repair, remediation, or replacement of pipes, backfill, video inspection of the repaired, remediated, or replaced pipe, and all other work associated with the repair, remediation, or replacement of unacceptable pipes.

The cost of mandrel testing shall be included in the cost of the pipe.

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 716.02 MATERIALS

SECTION 716, BEGIN LINE 81, DELETE, AND INSERT AS FOLLOWS:

716.02 Materials

Materials shall be in accordance with the following:

Clay Pipe, Extra Strength	907.08
Polyvinyl Chloride Pipe	~~907.23~~*
Reinforced Concrete Pipe	907.02
Smooth Wall Polyethylene Pipe	~~907.21~~*
Steel Pipe	908.11
Water	913.01
Cellular Grout	725

* *all thermoplastic pipe shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 718.02 MATERIALS

SECTION 718, BEGIN LINE 9, DELETE, AND INSERT AS FOLLOWS:

718.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class E or Higher, Size No. 8 or 9	904
Concrete, Class A	702
Geotextile for Underdrains	918.03
Reinforcing Bars	910.01
Sod, including Nursery Sod	621
Structure Backfill	904
Underdrain Pipe	715.02(d)
Underdrain Outlet Pipe	~~907.22, 907.24~~ *

* *all thermoplastic pipe shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 907 – CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS

SECTION 907, BEGIN LINE 137, DELETE, AND INSERT AS FOLLOWS:

907.16 ~~P~~*Thermop*lastic Pipe ~~Manufacturer~~ Requirements

A list of approved ~~P~~*thermop*lastic ~~P~~*p*ipe *and pipe liner*~~, Fittings, Solvent Cement, and Elastomeric Seals~~ will be maintained by the Department. The list will specify the manufacturer, *and thermo*plastic pipe~~, solvent cement, or elastomeric seals~~ designation. All of these materials shall comply with the applicable AASHTO or ASTM requirements *listed in the following table* and will only be accepted from qualified manufacturers. *The maximum allowable nominal diameter of thermoplastic pipe provided in accordance with 907.19, 907.20, 907.21, 907.22, or 907.23 shall be 36 in. (900 mm) unless otherwise noted.* The manufacturer is defined as the plant which produces the *thermo*plastic pipe, ~~fittings, solvent cements, or elastomeric seals~~. The manufacturer shall become qualified by establishing a history of satisfactory quality control of these materials as evidenced by the test results performed by the manufacturer's testing laboratory.

~~Manufacturers requesting to be qualified to supply plastic pipe, fittings, solvent cements, or elastomeric seals shall submit the following to the Materials and Tests Division.~~

~~(a) a quality control plan which encompasses all aspects of the production process starting with the raw materials and concluding with the shipment of the finished product. The quality control plan shall provide for a 95% or greater statistical assurance that the materials will be in accordance with the specifications, and include type and frequency of sampling and testing;~~

~~(b) documentation indicating that the manufacturer's testing laboratory is in accordance with the provisions of AASHTO R 18;~~

~~(c) a monthly summary of all test results for the previous 12 months production for each type of plastic pipe, fittings, solvent cements and elastomeric seals;~~

~~(d) a material safety data sheet for each material produced; and~~

~~(e) to maintain qualification, the manufacturer shall submit to the Materials and Tests Division a monthly summary of all tests for each type of pipe, pipe fittings, solvent cements, and elastomeric seals produced. If a specific type of pipe, pipe fitting, solvent cement, or elastomeric seals is not manufactured in a given month, the monthly submittal shall state: "No type _____ pipe, pipe fitting, solvent cement, or elastomeric seals was manufactured during the month of _____, 20__".~~

~~The manufacturer shall provide the type of certification specified in the Frequency Manual and in accordance with 916 which designates that hydrostatic design basis, HDB, rated resins or non-HDB rated resins were used in the manufacture of the pipe and fittings.~~

SUMMARY OF THERMOPLASTIC PIPE SPECIFICATION REQUIREMENTS				
Pipe Material	*INDOT Spec.*	*AASHTO Spec.*	*ASTM Spec.*	*Manufacturer Requirements*
Corrugated Polyethylene Drainage Tubing	*907.17*	*M 252*		*ITM 806, Procedure A*
Perforated Polyvinyl Chloride Semicircular Pipe	*907.18*		*D 3034*	*ITM 806, Procedure A*
Corrugated Polyethylene Pipe	*907.19*	*M 294*		*ITM 806, Procedure O*
Ribbed Polyethylene Pipe	*907.20*		*F 894*	*ITM 806, Procedure A*
Smooth Wall Polyethylene Pipe	*907.21*		*F 714*	*ITM 806, Procedure A*
Profile Wall Polyvinyl Chloride Pipe	*907.22*	*M 304*	*F 949*	*ITM 806, Procedure A*
Smooth Wall Polyvinyl Chloride Pipe	*907.23*	*M 278*	*F 679*	*ITM 806, Procedure A*
Type PSM Polyvinyl Chloride Pipe and Fittings	*907.24(a)*		*D 3034*	*ITM 806, Procedure A*
Schedule 40 Polyvinyl Chloride Pipe	*907.24(b)*		*D 1785*	*916, Type C Cert.*

907.17 Corrugated Polyethylene Drainage Tubing

Tubing and fittings shall be in accordance with AASHTO M 252. Perforations shall be required for tubing used as a longitudinal underdrain. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.18 Perforated Polyvinyl Chloride Semicircular Pipe

Perforated polyvinyl chloride semicircular pipe may be used as an alternate to 6 in. (150 mm) or less diameter pipe or tile. Pipe shall be in accordance with ASTM D 3034, SDR 35. This semicircular pipe shall have a smooth top and a smooth, semicircular bottom, nominally 4 5/8 in. (118 mm) in diameter, with perforations uniformly distributed along the top of the bottom section in accordance with AASHTO M 252 perforation requirements. The top section shall extend a minimum of 1/2 in. (13 mm) beyond the top of the semicircular section. The top section shall be approximately 6 3/8 in. (162 mm) wide including the sloping overhangs on each side. Qualification

requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.19 Corrugated Polyethylene Pipe

Pipe and fittings shall be in accordance with AASHTO M 294. ~~The compound used in manufacturing this pipe shall have a minimum cell class in accordance with 335420C as shown in ASTM D 3350.~~ Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure O*.

907.20 Ribbed Polyethylene Pipe

Pipe and fittings shall be in accordance with ASTM F 894 ~~for the specified sizes~~. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.21 Smooth Wall Polyethylene Pipe

Pipe shall be in accordance with ASTM F 714 for nominal diameters of 39 in. (1000 mm) or less. Fittings shall be in accordance with ASTM F 1055. The pipe sizes shall be in accordance with ISO sizing system. The pipe dimension ratio shall be 26 or less. ~~The compound used in manufacturing this type of pipe shall have a minimum cell class in accordance with 335434C as shown in ASTM D 3350~~. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.22 Profile Wall Polyvinyl Chloride Pipe

Pipe and fittings shall be in accordance with AASHTO M 304 *or ASTM F 949* ~~for nominal diameters of 36 in. (900 mm) or less~~. Perforations shall be required when used as a longitudinal underdrain or end bent drain pipe. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.23 Smooth Wall Polyvinyl Chloride Pipe

Pipe and fittings shall be in accordance with AASHTO M 278 for pipe sizes 4 in. through 15 in. (100 mm through 375 mm), and ASTM F 679 for pipe sizes 18 in. through 27 in. (450 mm through 675 mm). ~~The compound used in manufacturing pipe shall have a minimum cell class in accordance with 12454C as shown in ASTM D 1784.~~ Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.24 Smooth Wall Pipe for Outlets

Pipe and pipe fittings shall be smooth wall, non-perforated plastic pipe. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

(a) Type PSM Polyvinyl Chloride Pipe and Fittings

Pipe and fittings shall be in accordance with ASTM D 3034, SDR 23.5.

(b) Schedule 40 Polyvinyl Chloride Pipe

Pipe shall be in accordance with ASTM D 1785 and shall have a minimum pipe stiffness of 150 psi (1030 kPa) at 5% deflection when determined in accordance with ASTM D 2412. *Material furnished under this specification shall be covered by a Type C Certification in accordance with 916 and shall reference ASTM D 1785 in the product printline.*

907.25 Thermoplastic Pipe Liners

Thermoplastic pipe liners shall be high density polyethylene or polyvinyl chloride pipe with sufficient rigidity to withstand the installation operation and shall exhibit a minimum amount of distortion. The liner shall be free from visible cracks, holes, foreign inclusions, or other defects. Thermoplastic pipe liners may be added to the Department's approved list by completing the requirements of ITM 806, Procedure A.

(a) Solid Wall HDPE Pipe Liner

Solid wall HDPE pipe liner shall be in accordance with ASTM F 714. The maximum standard dimension ratio, SDR, for the liner as defined in ASTM F 412 shall be 32.5. ~~The resin used in the fabrication of the liner shall have a minimum cell classification of 345464C as shown in ASTM D 3350.~~

A 12 in. (300 mm) section of the liner shall show no evidence of splitting, cracking, or breaking when compressed between parallel plates to 40% of its outside diameter within 2 to 5 min.

(b) Profile Wall HDPE Pipe Liner

Profile wall HDPE pipe liner shall be in accordance with ASTM F 894. The minimum liner ring stiffness constant, RSC, shall be 100. ~~The resin used in the fabrication of the liner shall have a minimum cell classification of 345434C as shown in ASTM D 3350.~~

(c) Profile Wall PVC Pipe Liner

Profile wall PVC pipe liner shall be in accordance with ASTM F 949, ~~with the exception that PVC material with a minimum cell classification of 12454B as shown in ASTM D 1784 is added to the list of acceptable PVC materials~~.

907.26 Solvent Cements for Polyvinyl Chloride Pipe and Pipe Fittings

Solvent cement for polyvinyl chloride pipe and fittings shall be in accordance with ASTM D 2564. ~~Qualification requirements for the manufacturers of this material shall be in accordance with 907.16~~*Material furnished under this specification shall be covered by a Type C Certification in accordance with 916.*

REVISION TO SECTION 907 – CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS (CONTINUED)

907.27 Elastomeric Seals

Elastomeric seals for joining plastic pipe shall be in accordance with ASTM F 477. ~~Qualification requirements for the manufacturers of this material shall be in accordance with 907.16.~~ *Material furnished under this specification shall be covered by a type B Certification in accordance with 916. The results of the following tests shall be provided on the type B certification.*

Test	*ASTM*
Tensile Strength	*D 412 or D 1414*
Ultimate Elongation	*D 412 or D 1414*
100% Modulus	*D 412 or D 1414*
Hardness (Durometer)	*D 2240 or D 1414*
Low-Temperature Hardness	*D 2240 or D 1414*
Compression Set	*D 395 Method B, or D 1414*
Accelerated Aging	*D 573*
Water Immersion	*D 471*
Ozone Resistance	*D 1149*
Elastomer Compound Effect on Pipe	*F 477*
Force Decay (Stress Relaxation)	*F 913*

REVISION TO THE STANDARD SPECIFICATIONS (OLD BUSINESS ITEM)

REVISION TO SECTION 908.14 SLOTTED DRAIN OR SLOTTED VANE DRAIN PIPE

SECTION 908, BEGIN LINE 216, DELETE, AND INSERT AS FOLLOWS:

Slotted vane drain pipe shall be *smooth wall* polyvinyl chloride ~~in accordance with 907.23~~ *from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16*, and shall be of the diameter specified. The casting shall be in accordance with 910.05(b). The finish shall be standard black asphalt emulsion. Individual units shall have a minimum weight (mass) of 155 lb (70 kg).

COMMENTS AND ACTION (OLD BUSINESS ITEM)

REVISION TO SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS
REVISION TO SECTION 716.02 MATERIALS
REVISION TO SECTION 718.02 MATERIALS
REVISION TO SECTION 907 – CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS
REVISION TO SECTION 908.14 SLOTTED DRAIN OR SLOTTED VANE DRAIN PIPE

Mr. Walker explained the basic need for the changes to the specification. Then Mr. Reilman and Mr. Anderson explained the changes that were made from the previous submittal. The goal of this submission was to address mandrel testing and INDOT's desire to move to the NTPEP program for thermoplastic pipe.

Mr. Miller noted that the section on mandrel testing was nothing new and that it was to clarify what to do in terms of testing. Mr. Rogers had some concerns about the wording for when to replace a pipe. He cited AASHTO Section 30 and the fact it allows for a pipe to be remediated when the proposed spec calls for replacement. He would prefer to see the spec follow AASHTO Section 30 more closely. Mr. Walker felt that the wording in the proposed spec was open enough as it left room for a professional engineer's recommendation. Mr. Miller then suggested that if the diameter was less than 95%, it should be evaluated by a professional engineer, and that would require removal of part (a) under the section listing reasons for replacement.

Mr. Wathen pointed out that there is a need to address pipe items that only need video or visual inspection, specifically profile wall pipe. He cited that the manufacturer' website even states that it should be installed in accordance with AASHTO Section 30. Mr. Miller stated that this spec revision was just to clean up the existing spec, and that that nothing new was being added. What Mr. Wathen was proposing was a change to the spec on profile wall pipe and that would need to go through the pipe committee.

One of the representatives from CONTECH asked about the wording for the mandrel test. It states the Contractor shall pull the mandrel, but can a manufacturer representative do the test or must it be the contractor? Mr. Miller stated that that would be possible. It was the intent of the spec that INDOT staff does not perform the test. Also, it was asked if the 95% requirement was 95% of the nominal diameter or 95% of the pay item diameter. The initial answer was 95% of the pay item diameter. However, after further evaluation, it should be 95% of the nominal diameter.

COMMENTS AND ACTION (OLD BUSINESS ITEM) (CONTINUED)

REVISION TO SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS
REVISION TO SECTION 716.02 MATERIALS
REVISION TO SECTION 718.02 MATERIALS
REVISION TO SECTION 907 – CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS
REVISION TO SECTION 908.14 SLOTTED DRAIN OR SLOTTED VANE DRAIN PIPE

Motion: Mr. Walker
Second: Mr. Cales
Ayes: 9
Nays: 0

Standard Specifications Sections affected:
715.02, 715.09, 715.13, 715.14, 716.02, 718.02, 907.16, 907.17, 907.18, 907.19, 907.20, 907.21, 907.22, 907.23, 907.24, 907.25, 907.26, 907.27, 908.14

Recurring Special Provision affected:

None

Standard Sheets affected:

None

GIFE Sections affected:

Section 4.11

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

_____ 20__ Standard Specifications Book

__X__ Create RSP (No. 715-R-574
MANDREL TESTING OF THERMOPLASTIC PIPES)
Effective Sept. 01, 2010 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 X
By _____ Addition or _____ Revision

Received FHWA Approval? X

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS AND STANDARD DRAWINGS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: INDOT is receiving a lot of pavement designs for trail projects and the number of projects is starting to get unmanageable.

PROPOSED SOLUTION: Create standard pavement sections that can be used throughout the state.

APPLICABLE STANDARD SPECIFICATIONS: 207.06, 404, 502

APPLICABLE STANDARD DRAWINGS: 402-NVUF-01, 402-NVUF-02, 502-NVUF-01

APPLICABLE DESIGN MANUAL SECTION: 51-7.06

APPLICABLE SECTION OF GIFE: N/A

Submitted By: John Wright

Title: Roadway Services Manager

Organization: INDOT

Phone Number: 232-5147

Date: 11/30/09

Item No. 01 01/21/10 (2010 SS)
Mr. Wright
Date: 01/21/10

REVISION TO THE STANDARD SPECIFICATIONS AND STANDARD DRAWINGS

REVISION TO SECTION 207.04 SUBGRADE TREATMENT
REVISION TO SECTION 207.06 BASIS OF PAYMENT

The Standard Specifications are revised as follows:

SECTION 207, BEGIN LINE 110, INSERT AS FOLLOWS:

TYPE ~~IIIB~~ V 3 in. (75 mm) of subgrade excavated and replaced with 3 in. (75 mm) coarse aggregate No. 53.

SECTION 207, BEGIN LINE 127, INSERT AS FOLLOWS:

The existing railroad ballast and railroad bed material shall be excavated to the depth specified for subgrade treatment, type ~~IIIB~~ V and graded as shown on the plans, or as directed by the Engineer, in order to provide the subgrade width required for the proposed pavement section, including side slopes. Excavation and grading of the ballast and bed material shall include any cuts and fills necessary to account for erosion or degradation of the ballast in localized areas. Cuts and fills shall be balanced within sections approximately 300 feet in length along the profile of the pavement. The graded ballast and bed material shall be compacted in accordance with the applicable provisions of 203 prior to placement of the coarse aggregate No. 53. The 3 in. (75 mm) compacted aggregate as part of the Subgrade treatment type ~~IIIB~~ V shall be compacted to 100% prior to the placement of the pavement.

SECTION 207, BEGIN LINE 157, INSERT AS FOLLOWS:

The cost of excavation and grading of existing railroad ballast and railroad bed material shall be included in the cost of subgrade treatment, type ~~IIIB~~ V.

REVISION TO IDM 51-7.06 PAVEMENT SECTION

51-7.06 Pavement Section

A hard, all-weather pavement surface is preferred to that of crushed aggregate, sand, clay or stabilized earth, since these materials provide a much lower level of service and require higher maintenance. In an area that is subjected to frequent or occasional flooding or drainage problems, or in an area of steep terrain, an unpaved surface will often erode, so therefore it is not recommended.

A quality all-weather pavement structure can be constructed of hot-mix asphalt or portland-cement concrete. ~~It is not practical to provide specific or recommended typical pavement sections that are applicable statewide, due to variations in soils, loads, materials, construction practices, or varying costs of pavement materials.~~

Designing and selecting the pavement section for a shared-use path is similar to designing and selecting a highway pavement section. The pavement section for a shared-use path should be designed with consideration given to the quality of the subsoil and anticipated loads. The principal loads will be from maintenance or emergency vehicles. These vehicles should be restricted to axle loads of less than 4.5 tons, especially in the spring.

~~The subgrade and pavement-section recommendations are subject to the approval of the Office of Pavement Engineering. Such approval should be included in the project's design documentation.~~ *See INDOT Standard Drawings for Typical Sections.*

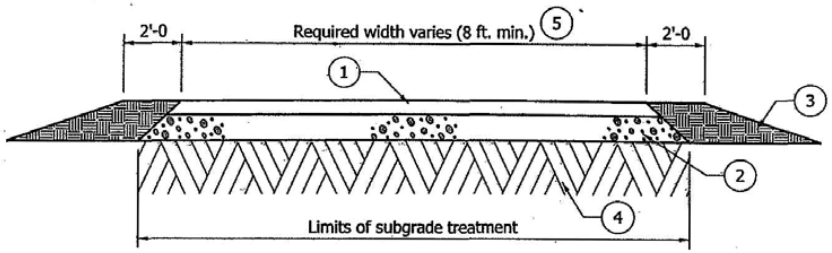
A smooth riding surface should be constructed and maintained on a shared-use path. For a portland-cement-concrete pavement, the transverse joints necessary to control cracking should be saw cut to provide a smooth ride. However, skid-resistance qualities should not be sacrificed for the sake of smoothness. A broom-finished or burlap-dragged concrete surface is preferred.

If a motor vehicle is driven on a shared-use path, its wheels will often be at or near the edges of the path. This can cause edge damage that, in turn, will reduce the effective operating width of the path. A pavement width of less than 10 ft is not recommended. If a facility width of less than 10 ft is necessary; only narrower-track-width motor vehicles should be permitted on it.

At an unpaved roadway or drive crossing with a shared-use path, the roadway or drive should be paved for a minimum of 10 ft on each side of the crossing to reduce the amount of gravel being scattered onto the path by motor vehicles. The pavement structure at the crossing should be adequate to sustain the expected loading at that location.

REVISION TO THE STANDARD SPECIFICATIONS AND STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E402-NVUF-01 HMA TYPICAL SECTION



HMA TYPICAL SECTION

LEGEND

1. 140 lb/yd² HMA Surface Type A, on 220 lb/yd² HMA Intermediate, Type A
2. 6 in. Compacted Aggregate No.53, Base
3. Earth Shoulder
4. Subgrade Treatment (6" Coarse Aggregate No.53)
5. Width and Cross Slope as required

INDIANA DEPARTMENT OF TRANSPORTATION

HMA NONMOTORIZED-VEHICLE-USE FACILITY PAVEMENT SECTION

XXXXXXXXXX

STANDARD DRAWING NO. E 402-NVUF-01

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

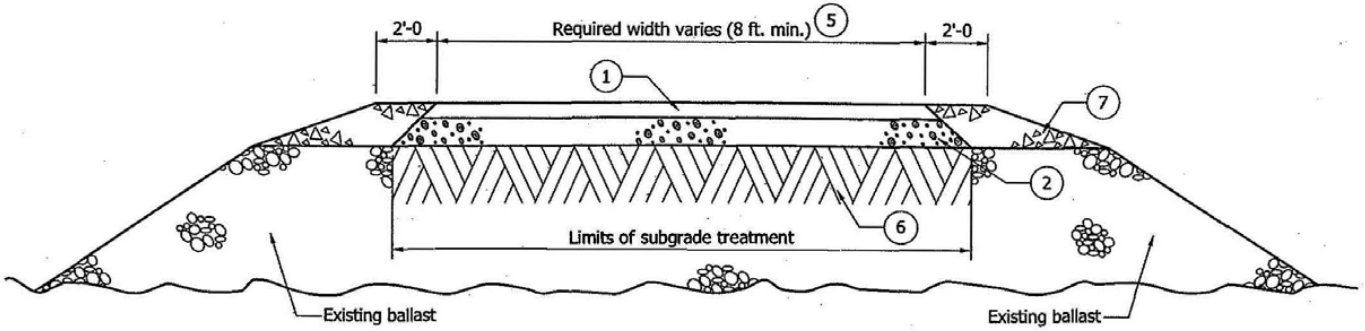
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave XX/XX/XX
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller XX/XX/XX
CHIEF HIGHWAY ENGINEER DATE

REVISION TO THE STANDARD SPECIFICATIONS AND STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E402-NVUF-02 HMA TYPICAL SECTION (FOR SHARED-USE PATHS ON ABANDONED RAILROAD CORRIDORS)



HMA TYPICAL SECTION

(For Shared-Use Paths on Abandoned Railroad Corridors)

LEGEND

1. 140 lb/yd² HMA Surface Type A, on 220 lb/yd² HMA Intermediate, Type A
2. 6 in. Compacted Aggregate No.53, Base
5. Width and Cross Slope as required
6. Subgrade treatment (3" subgrade excavated and replaced with 3" Coarse Aggregate No. 53)
7. Variable-Depth Compacted Aggregate Size No.53 or No.73

INDIANA DEPARTMENT OF TRANSPORTATION

HMA NONMOTORIZED-VEHICLE-USE FACILITY PAVEMENT SECTION

XXXXXXXXXX

STANDARD DRAWING NO. E 402-NVUF-02

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

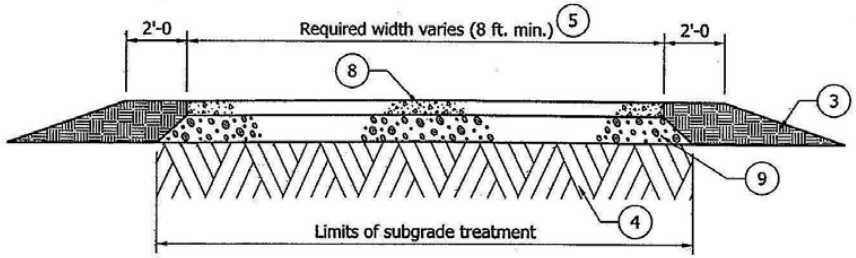
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave XX/XX/XX
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller XX/XX/XX
CHIEF HIGHWAY ENGINEER DATE

REVISION TO THE STANDARD SPECIFICATIONS AND STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E502-NVUF-01 PCCP TYPICAL SECTION



PCCP TYPICAL SECTION

LEGEND

3 Earth Shoulder

4 Subgrade Treatment (6" Coarse Aggregate No.53)

5 Width and Cross Slope as required

8 4 inches of PCCP with 1/8" saw cut Transverse Joint spaced at 8 feet without Dowel Bars

9 4 in. compacted Aggregate No. 53, Base

INDIANA DEPARTMENT OF TRANSPORTATION

PCCP NONMOTORIZED-VEHICLE-USE FACILITY PAVEMENT SECTION

XXXXXXXXXX

STANDARD DRAWING NO. E 502-NVUF-01

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave XX/XX/XX
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller XX/XX/XX
CHIEF HIGHWAY ENGINEER DATE

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INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 09-__
Technical Advisory

November 24, 2009 DRAFT

TO: **All Design, Operations, and District Personnel, and Consultants**

FROM: _____
Anthony L. Uremovich
Design Resources Engineer
Production Management Division

SUBJECT **Nonmotorized-Vehicle-Use Facility Pavement Sections**

REVISES: ***Indiana Design Manual*** **Section 51-7.06**

EFFECTIVE: **_____, 2010, Letting**

Standard nonmotorized-use-facility pavement sections have been developed. A hot-mix asphalt pavement section is included for use on an abandoned railroad corridor, and another section is included for use elsewhere. A portland-cement concrete pavement section is also included. The use of asphalt or concrete will likely be based on the preference of a local public agency. The use of these standard sections will not require pavement-section approval by the Office of Pavement Engineering.

The sections appear on INDOT Standard Drawings 402-NVUF-01 and -02, and 502-NVUF-01. Recurring Special Provision 207-R-___ should be called for if one or more of the pavement sections is specified. These documents are attached herewith.

alu

[P:\Structural Services\Design Memos\Pending\2009\09NVUF-ta.doc]

COMMENTS AND ACTION

REVISION TO SECTION 207.04 SUBGRADE TREATMENTS
REVISION TO SECTION 207.06 BASIS OF PAYMENT
REVISION TO IDM 51-7.06 PAVEMENT SECTIONS
PROPOSED NEW STANDARD DRAWINGS:TYPICAL SECTIONS
E402-NVUF-01, E402-NVUF-02, E502-NVUF-01

Mr. Wright explained the need for the changes to this spec. Mr. Andrewski added that it was an attempt to standardize the subgrade treatment for trails and it can handle maintenance vehicles. Mr. Shield s asked about why the re was not an option for concrete o n ballast and the an swer was that the ba llast did not provide a rigid enough base for the concrete. The more flexible asphalt was a much better option.

Mr. Cales suggested that Type IIIB was not a good option as it was not related to any of the other Type III options. The type was then changed to V. Mr. Keefer commented that he was not certain how easy it would be to remove just 3" of the existi ng ballast for t he subgrade treatment. Mr. Wright stated that the intent was to make sure the vegetation was removed.

Motion: Mr. Wright Second: Mr. Andrewski Ayes: 9 Nays: 0	Action: _____ Passed as Submitted __X__ Passed as Revised _____ Withdrawn
Standard Specifications Sections affected: 207.04; 207.06	__X__ 2012 Standard Specifications Book __X__ Create RSP (No. 207-R-575 SUBGRADE TREATMENT FOR TRAILS) Effective July 01, 2010 Letting RSP Sunset Date: _____
Recurring Special Provision affected: None	_____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Standard Sheets affected: None	Standard Drawing Effective _____ __X__ Create RPD (No. 402-R-571d; 402-R-572d; 502-R-573d) Effective July 01, 2010 Letting
Design Manual Sections affected: Section 51-7.06	__X__ Technical Advisory
GIFE Sections affected: None	GIFE Update Req'd.? Y ___ N _X_ By _____ Addition or _____ Revision Frequency Manual Update Req'd? Y___N___ By _____ Addition or _____ Revision Received FHWA Approval? _X_

SPECIFICATION REVISIONS

SPECIAL PROVISION

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Currently, unique special provisions are being used to incorporate requirements for wrecker services and incident management into contracts when determined necessary by the project designers.

PROPOSED SOLUTION: The Public Safety Operations Division proposes creation of Recurring Special Provisions for "Wrecker Service" and "Incident Management Cooperation" that will standardize the language used in contracts when these items are deemed necessary.

APPLICABLE STANDARD SPECIFICATIONS: 104.04, 801

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: Chapter 81

APPLICABLE SECTION OF GIFE: Section 2.9

APPLICABLE RECURRING SPECIAL PROVISIONS: None

Submitted By: Ron Heustis for Kim Peters

Title: Incident Management Program Director

Organization: INDOT

Phone Number: 317-899-8619

Date: 12-14-09

APPLICABLE SUB-COMMITTEE ENDORSEMENT?None

RECURRING SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: INCIDENT MANAGEMENT COOPERATION

INCIDENT MANAGEMENT COOPERATION

The Contractor is advised that the Department will be implementing an incident management system on this project. The Contractor shall cooperate in coordination between key project personnel and the various agencies responding to crashes and incidents within the limits of the project. This system makes the best use of the assets available to obtain access to the incident scene for emergency vehicles as quickly and safely as possible and return traffic flows to normal with the least inconvenience to the motoring public. This system will also better facilitate responses to injured workers within the project area.

The Department will establish an Incident Management Task Force, IMTF, comprised of many of the agencies that will likely be involved in the event of an emergency within or adjacent to the work zone.

The IMTF is responsible for establishing an Incident Management Plan, IMP, that defines the procedures that specifically address detection, verification, response, management, and clearance of incidents within or adjacent to the work zone. The Contractor shall assign at a minimum the designated certified worksite traffic supervisor, CWTS, to participate in the ITMF as the Contractor's incident management liaison.

Prior to the start of construction the CWTS shall arrange with the Engineer for an incident management training session, to be conducted by the Department, for the Contractor's key personnel including, but not limited to, superintendents, lead foremen, and wrecker service operators. The training session will last approximately 2 hours and will focus on familiarizing the Contractor's personnel with the IMP and all procedures developed by the IMTF that shall be followed throughout the project. The CWTS shall inform the Contractor's key personnel when changes to the Incident Management Plan are implemented.

The CWTS shall coordinate all incident response requirements per the Indiana Design Manual, Chapter 81, Traffic Incident Management Plan with the Department's incident management coordinator, who will be identified at the pre-construction conference by the Engineer.

The CWTS shall prepare and distribute incident management maps, as approved by the Engineer, to agencies identified by the IMTF. Maps shall be updated at a minimum of once per change of phase in maintenance of traffic plan or as directed by the IMTF. The maps shall be no larger than 11 in. x 17 in (279 mm X 432 mm), printed in full color, to scale, and include at a minimum the following:

1. Outline of the roadway horizontal geometry.
2. Open travel lanes or ramps colored in green.
3. Closed travel lanes or ramps with active construction in orange.
4. Closed travel lanes or ramps accessible to emergency traffic in red.

RECURRING SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: INCIDENT MANAGEMENT COOPERATION (CONTINUED)

5. Fire hydrants within 500 ft (178 m) of the state right-of-way. Fire hydrant location information is available from the local water utility.
6. Temporary emergency vehicle access points with identifiers defined by the Engineer.
7. Rally points for emergency vehicle escorts into the work area with identifiers defined by the Engineer.
8. Control points, such as mile markers and block numbers and any other control point designated by the Engineer.
9. Emergency road closure diversion points with identifiers defined by the Engineer.
10. Diversion equipment locations with quantities.
11. All entrance and exit ramps uniquely identified and labeled.

The CWTS shall meet with local fire department representatives no less than 10 days prior to a change in the maintenance of traffic pattern to coordinate computer aided dispatch response plans.

The CWTS shall arrange for IMTF meetings as follows:

1. Initial meeting a minimum of 14 days prior to a phase change in the maintenance of traffic pattern.
2. Supplementary meeting a minimum of 7 days prior to a change in the maintenance of traffic pattern.
3. A minimum of 1 meeting per month during any maintenance of traffic phase with a duration of more than 30 days.

The CWTS shall maintain the list of IMTF members. The list shall include, at a minimum, the name, agency, work phone, fax, email, pager, and agency vehicle number for each task force member. The list shall be sorted in alphabetical order by agency and member's last name. The CWTS shall notify members of the IMTF of meetings no later than 14 days prior to the meeting.

The CWTS shall arrange for other meetings as necessary with the IMTF. The Department's incident management coordinator will determine the need for these meetings depending on the project complexity.

The Contractor shall submit a contact list of designated on-call personnel with authority to mobilize and coordinate the Contractor's resources. The on-call person shall be available to respond to calls 24 hours per day and 7 days per week from the Engineer, wrecker service operators and emergency agency personnel. In the event of an incident, the on-call person shall be able to respond in no longer than 30 minutes to the site to oversee the use of the Contractor's resources to help resolve an incident. The on-call person shall be prepared to contact any necessary Contractor's personnel outside normal working hours. The Contractor's on-call personnel will not be required to meet the 30 minute response time when all lanes and ramps are open to normal traffic.

RECURRING SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: INCIDENT MANAGEMENT COOPERATION (CONTINUED)

In the event of a major incident whil e construction oper ations are underway, the Contractor's personnel may be required to assist in establishing immediate road or ramp closures to isolate incident scenes. If necessar y the Contractor sh all provide for h eavy equipment from on-site to ass ist in moving wreck age or debris from the travel lanes and realignin g temporary barrier s to facilitate re opening the road to normal traffic. The CWTS shall coordinate these activities with the emergency personnel on the sc ene and the Department's Traffic Management Center as applicable.

To facilitate with closures and provide current road cond itions in an emergency situation, the Contractor shall provide, at a minimum, the following equipment to be located as directed by the Engineer:

1. One flashing arrow sign for each in terstate mainline approach to the work zone including ramps leading to the work zone.
2. Twelve safety drums for every lane on the mainline where the flashing arrow sign is positioned.
3. Two portable changeable message signs equipped with Aries field processors, bluetooth transceivers, and data modems to facilitate remote control access by the Traffic Management Center, as applicable.

All costs necessary to provide incident management cooperation as defined herein shall be included in the cost of maintaining traffic.

COMMENTS AND ACTION

RECURRING SPECIAL PROVISION: INCIDENT MANAGEMENT COOPERATION

Motion: Second: Ayes: Nays: Standard Specifications Sections affected: 104.04; 801 Recurring Special Provision affected: None Standard Sheets affected: None Design Manual affected: Chapter 81 GIFE Sections affected: Section 2.9	Action: _____ Passed as Submitted _____ Passed as Revised __X__ 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: 01/21/10

SPECIFICATION REVISIONS

SPECIAL PROVISION

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Currently, unique special provisions are being used to incorporate requirements for wrecker services and incident management into contracts when determined necessary by the project designers.

PROPOSED SOLUTION: The Public Safety Operations Division proposes creation of Recurring Special Provisions for "Wrecker Service" and "Incident Management Cooperation" that will standardize the language used in contracts when these items are deemed necessary.

APPLICABLE STANDARD SPECIFICATIONS: 104.04, 801

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: Chapter 81

APPLICABLE SECTION OF GIFE: Section 2.9

APPLICABLE RECURRING SPECIAL PROVISIONS: None

Submitted By: Ron Heustis for Kim Peters

Title: Incident Management Program Director

Organization: INDOT

Phone Number: 317-899-8619

Date: 12-14-09

SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: WRECKER SERVICE

WRECKER SERVICE

Description

This work shall consist of providing wrecker service within and immediately adjacent to the project work zone. The purpose of the service is to provide aggressive intervention when a lane-restricting incident occurs within the coverage area.

A lane-restricting incident is defined as anything that restricts the flow of traffic or presents a hazard on a travel lane or paved shoulder. Wrecker service shall include both roving service and on-demand responsive service within the coverage area.

Equipment

Wreckers shall be equipped and maintained as described herein, and in accordance with the provisions of the Indiana Vehicle Code, and consistent with industry standards and practices. Wreckers shall be registered as a Recovery Vehicle with the Indiana Bureau of Motor Vehicles and at a minimum shall meet the equipment provisions of IC 9-18-13-3 and IC 24-4-6-2, except where more stringent requirements are specified herein.

Whenever only 1 wrecker is in operation on the project, it shall be a flat bed configuration capable of towing two vehicles. Whenever more than 1 wrecker is in operation on the project, at least 50% of those in operation shall be a flat bed configuration capable of towing two vehicles. In addition to the industry standard equipment for recovery vehicles, the wreckers shall also be equipped with the following items:

1. A rubber coated push bumper.
2. An activated cellular phone.
3. A Citizens Band Radio.
4. A “push to talk” radio programmed with each member on the incident management plan contact list.
5. Two 50 lb bags of oil dry.
6. Push broom.
7. Flat blade shovel.
8. 10 traffic cones.
9. One case of standard 30 minute highway flares.
10. Fist aid kit.
11. Two 20 lb type A, B, C fire extinguishers.
12. A 2.5 ton floor jack and tire irons.
13. A 5 gallon water container with water.
14. A 5 gallon USDOT approved container with unleaded gasoline.
15. A 5 gallon USDOT approved container with diesel fuel.
16. A copy of the most recent Incident Management Plan as established by the Incident Management Task Force.

All wreckers meeting the definition of a commercial motor vehicle per 49CFR 390.5 which are used for this contract shall meet or exceed the Federal Motor Carrier Safety Regulations, FMCSR, as applicable. Each vehicle shall be presented to the Indiana State Police Commercial

SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: WRECKER SERVICE (CONTINUED)

Vehicle Enforcement Division for an inspection in accordance with 49CFR 396.17c prior to being used on the project. The Contractor shall be responsible for making arrangements with the Indiana State Police Commercial Vehicle Enforcement Division for the inspection.

A copy of each wrecker inspection shall be provided to the Department's Public Safety Operations Division.

Wreckers shall have magnetic or permanent letters placed upon the two sides of the vehicle that read "FREEWAY SERVICE PATROL." The letters shall be reflective and of a color approved by the Engineer. A unique vehicle number shall be prominently displayed on the front, sides, and rear of the wrecker.

Personnel

Wrecker operators shall be qualified to provide safe, reasonable operation of the wrecker equipment. The operators shall provide documentation to the Engineer that they have completed an American Red Cross basic first-aid course, or equivalent, and an 8 hour hazardous material first responder training class, or equivalent. Operators shall wear an ANSI/ISEA Performance Class 3 approved safety vest at all times when outside of the vehicle. The operator shall also wear clothing consistent with OSHA requirements for towing and recovery operators. The attire shall be professional in appearance. The operator's first name shall be displayed on their clothing or on an obvious identification card worn so it is readily visible to the public.

While performing their duties, operators are acting as agents of the State of Indiana and therefore shall conduct themselves in a respectful and courteous manner when interacting with the public and emergency services agencies.

Operators shall not accept gratuities or compensation from the public.

Operation

The wrecker shall be operated in accordance with the requirements herein and the procedures outlined in the Incident Management Plan. A copy of the Incident Management Plan will be provided by the Engineer.

Wreckers shall be operated within the patrol area whenever permanent traffic control devices are in place or lanes or shoulders are restricted. Service shall be scheduled as required by the Engineer. The required schedule may be adjusted by the Engineer with notification given a minimum of 8 hours in advance of any schedule change.

The coverage area for the wrecker shall generally be defined as the area encompassed within the limits of the outermost construction signs. The individual patrol routes will be approved by the Engineer in coordination with the coverage provided by the Department's Hoosier Helper Freeway Service Patrol units. Patrol routes shall be submitted for approval for each phase of the project a minimum of 14 days in advance of start of the project phase. Patrol route submissions shall indicate coverage for single unit operation and multiple unit operation.

SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: WRECKER SERVICE (CONTINUED)

Wrecker operators shall be proactive in helping to locate incidents in the coverage area. At a minimum, each wrecker assigned to a route must make a complete tour of the approved coverage area every 30 minutes during normal rush hours and every 60 minutes during off peak hours. When the project is within an area controlled by a Traffic Management Center, upon completion of each tour, the wrecker operator shall advise the Traffic Management Center of the status of the coverage area.

A shift log shall be maintained in each wrecker for each shift worked. A shift log form will be provided by the Department. The shift log shall document all activity performed during the shift including, but not limited to, incidents responded to, debris removed, motorists assisted, and traffic control devices maintained. Upon completion of a shift, a copy of the log sheet shall be submitted to the Engineer.

Designated drop off areas will be established by the Engineer for the placement of vehicles removed from the coverage area. Vehicles removed from the coverage area shall only be relocated to these designated areas. In cases where a vehicle will need further towing assistance and the project is within an area controlled by a Traffic Management Center, the wrecker operator shall contact the Traffic Management Center to arrange for further wrecker service. Otherwise, the wrecker operator shall contact the Indiana State Police to arrange for further wrecker assistance. The wrecker operator shall not recommend or contact any wrecker service directly, or use the project wrecker to further assist a motorist, but may contact a wrecker service if specifically requested by the motorist being assisted.

The operator shall assist in cleaning up incident scenes. This shall include at minimum spreading oil dry, sweeping debris from the roadway, repositioning traffic control devices, or any other activity that will reduce the closure time.

The Incident Management Plan will serve as the basis for interagency coordination for all incidents within the wrecker coverage area. The wrecker operator shall be knowledgeable of the policies and procedures contained in the Plan and comply with the requirements of the Plan.

The operators shall attend debriefing meetings as requested by the Engineer upon the completion of the various phases of work.

Method of Measurement

Wrecker service will be measured for each wrecker by the number of hours on duty in the coverage area or other area as directed by the Engineer. For the first 4 hours of duty, any time less than or equal to 4 hours will be measured as 4 hours. After the first 4 hours of duty, any portion of an hour will be measured as an hour.

SPECIAL PROVISION

PROPOSED RECURRING SPECIAL PROVISION: WRECKER SERVICE (CONTINUED)

Basis of Payment

Wrecker service will be paid for at the contract unit price per hour.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Wrecker Service	Hour

COMMENTS AND ACTION

RECURRING SPECIAL PROVISION: WRECKER SERVICE

Motion: Second: Ayes: Nays: Standard Specifications Sections affected: 104.04; 801 Recurring Special Provision affected: None Standard Sheets affected: None Design Manual affected: Chapter 81 GIFE Sections affected: Section 2.9	Action: _____ Passed as Submitted _____ Passed as Revised __X__ 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. Andrewski
Date: 01/21/10

SPECIFICATION REVISIONS

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The Mechanistic Empirical Pavement Design Guide's adoption by INDOT has decreased pavement thicknesses. The Standard Drawings E 610-PRAP-02, E 610-PRAP-03, E 610-PRAP-04, E 610-PRAP-06, E 610-PRAP-08, E 610-PRAP-10, and E 713-TCTR-04 need to be revised to reflect these changes.

PROPOSED SOLUTION: Revise traffic information and pavement section.

APPLICABLE STANDARD SPECIFICATIONS: 400 Section

APPLICABLE STANDARD DRAWINGS: E 610-PRAP-02, E 610-PRAP-03, E 610-PRAP-04, E 610-PRAP-05, E 610-PRAP-06, E 610-PRAP-07, E 610-PRAP-08, E 610-PRAP-09, E 610-PRAP-10, E 610-PRAP-11, E 610-PRAP-12, and E 713-TCTR-04

APPLICABLE DESIGN MANUAL SECTION: Chapter 82

APPLICABLE SECTION OF GIFE: Section 16

APPLICABLE RECURRING SPECIAL PROVISIONS: NA

Submitted By: David Andrewski

Title: Manager, Office of Pavement Engineering

Organization: INDOT

Phone Number: 317-232-5452

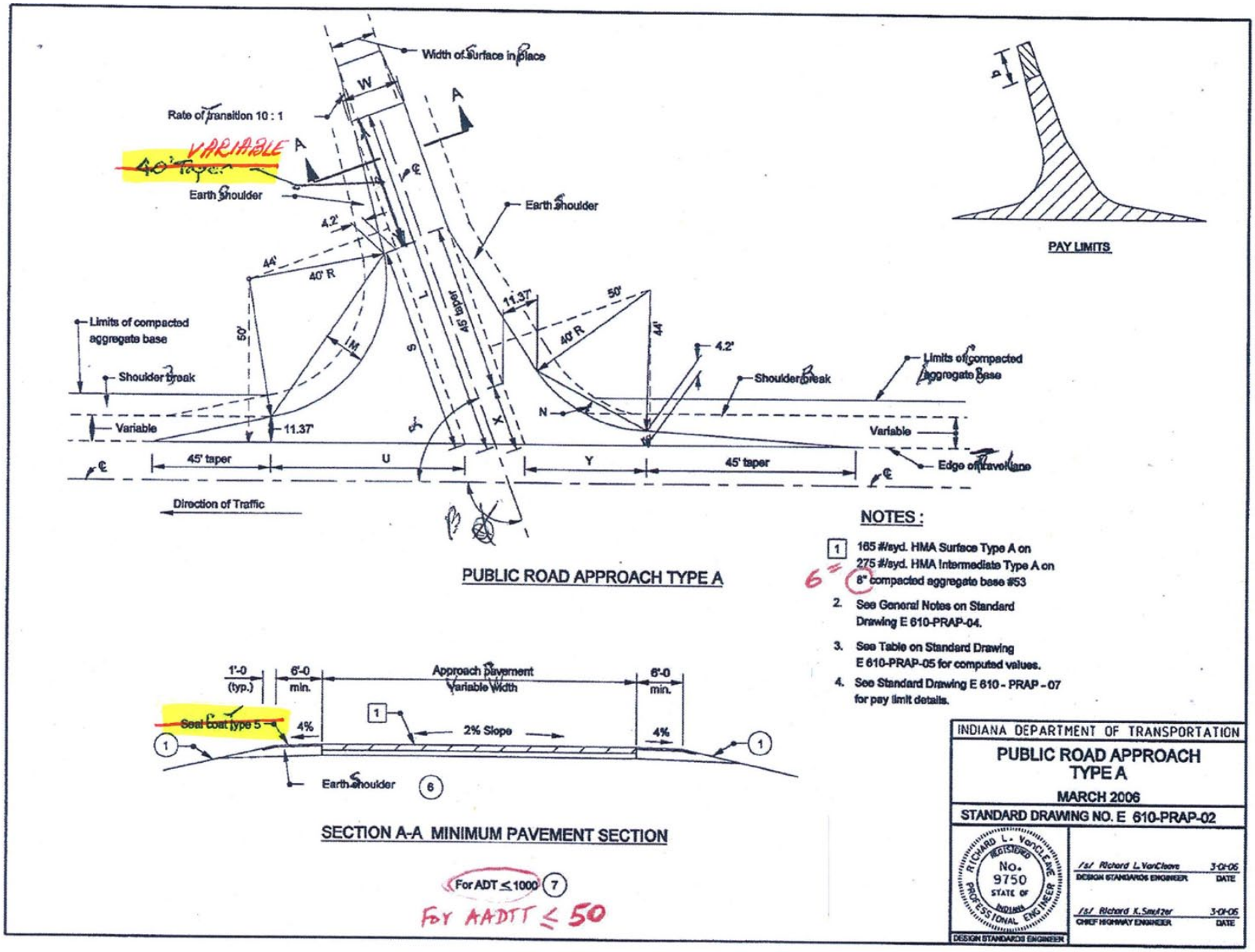
Date: December 17, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? Pavement Steering Committee

Item No. 04 01/21/10 (2010 SS)
Mr. Andrewski
Date: 01/21/10

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

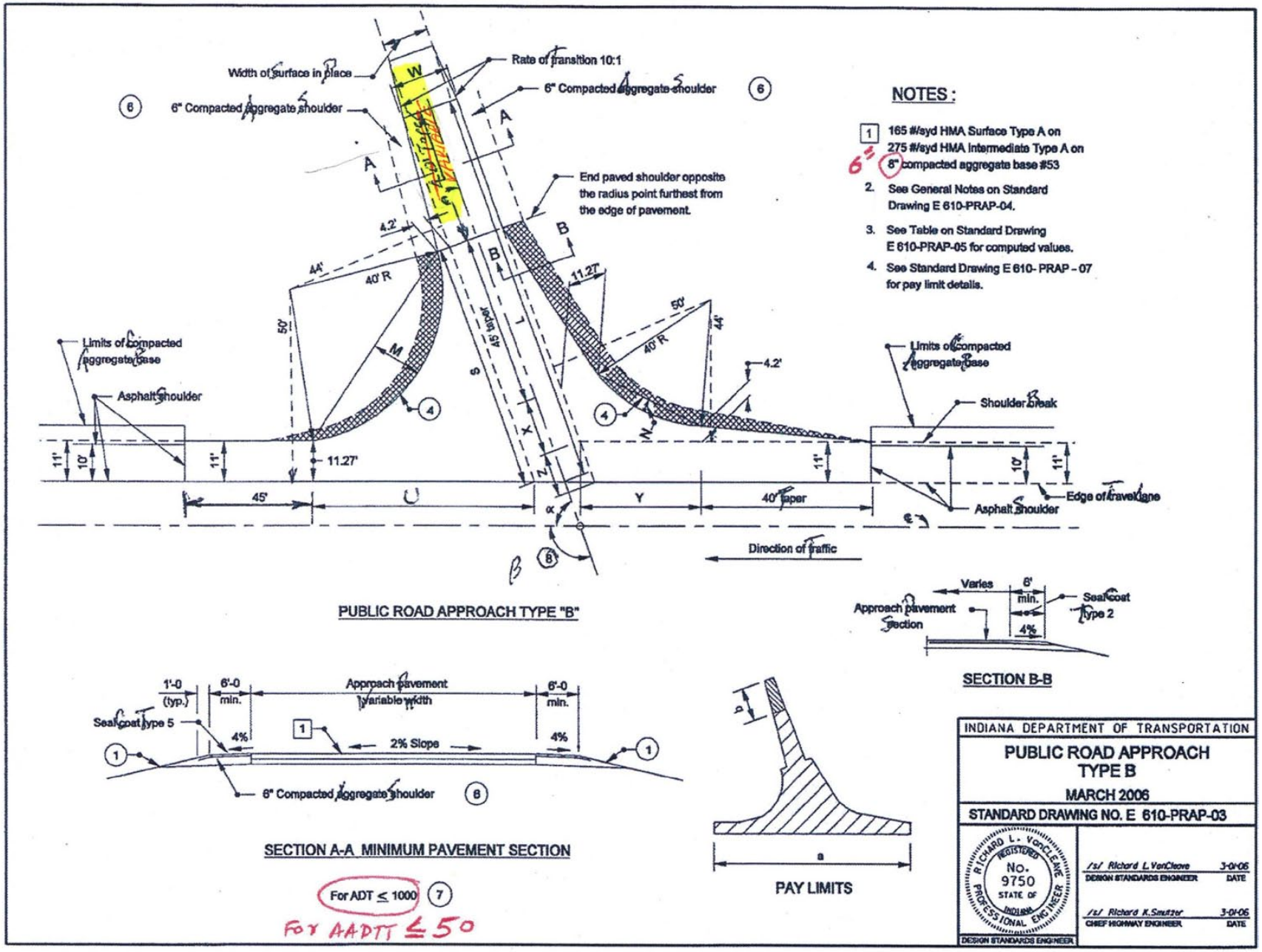
PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-02 PUBLIC ROAD APPROACH TYPE A



Item No. 04 01/21/10 (2010 SS)
Mr. Andrewski
Date: 01/21/10

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-03 PUBLIC ROAD APPROACH TYPE B



REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-04 PUBLIC ROAD APPROACH TYPE A & B – GENERAL NOTES

GENERAL NOTES

These notes are for Standard Drawings E 610-PRAP-02, -03, and -05.

(1) Embankment slopes on either side of an approach or drive within the mainline clear zone for new construction/reconstruction projects or the obstruction free zone on 3R projects should conform to the following table:

DESIGN YEAR		High, ≥ 50 mph		Low, ≤ 45 mph
Design Year AADT		≥ 6000	< 6000	All
Multi-Lane Divided, All Functional Class.	Incoming Slope	10:1	10:1	10:1
	Outgoing Slope	4:1	4:1	4:1
Multi-Lane Undivided, All Functional Class.	Incoming Slope	10:1	6:1	6:1
	Outgoing Slope	4:1	4:1	4:1
2-Lane Arterial or collector		6:1	6:1	4:1
2-Lane Local Road		4:1	4:1	4:1

Outside the clear zone or the obstruction free zone, the embankment slopes should desirably be 4:1 but not steeper than 3:1.

2. Cross culverts under the public road approach which cannot be located outside the mainline clear zone will require appropriate end treatments.

(4) The cross hatched ⊠ shoulder area indicates the limits where the shoulder is the same as the approach pavement.

5. If the approach is to be constructed of PCCP, the details shall be as shown elsewhere in the plans for thickness, joint type, and location.

(6) Earth shoulder shall be used with the Type A public road approach. The Type B public road approach shall have 6 in. compacted aggregate and full approach pavement section shoulders as shown on the Type A approach detail.

(7) If the ADT (AADTT) for the public road is greater than 1000 (50), the required pavement section shall be as shown elsewhere in the plans.

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH
TYPE A & B - GENERAL NOTES

SEPTEMBER 2007

STANDARD DRAWING NO. E 610-PRAP-04

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/04/07
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/04/07
CHIEF HIGHWAY ENGINEER DATE

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-05 PUBLIC ROAD APPROACH TYPE A & B – TABLE OF VALUE

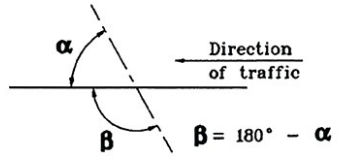
β	U	S	M	X	Y	N	L							TOTAL APPROACH AREA A						Hatched shoulder area	C.A.B. shoulder area	β
							TYPE A			TYPE B				TYPE A			TYPE B					
							W=20	W=22	W=24	W=20	W=22	W=24	Z	W=20	W=22	W=24	W=20	W=22	W=24			
(°)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(°)
110	55.02	65.23	11.66	18.63	33.20	3.72	108.87	109.23	109.60	108.87	109.23	109.60	11.71	531.19	556.20	501.52	645.05	670.14	695.38	112.40	52.60	110
109	53.75	64.04	11.42	19.32	33.74	3.86	107.48	107.82	108.17	107.48	107.48	108.17	11.63	524.90	549.63	574.51	639.55	664.28	689.15	112.50	51.00	109
108	52.51	62.88	11.19	20.02	34.28	4.02	106.12	106.45	106.77	106.12	106.45	106.77	11.57	518.88	543.25	567.78	634.32	658.70	683.22	112.60	49.50	108
107	51.30	61.74	10.94	20.72	34.84	4.17	104.80	105.10	105.41	104.80	105.10	105.41	11.50	513.11	537.15	561.32	629.37	653.40	677.37	112.60	48.00	107
106	50.11	60.64	10.70	21.44	35.40	4.33	103.50	103.79	104.48	103.50	103.79	104.08	11.44	507.60	531.30	555.13	624.67	648.37	672.20	112.80	46.40	106
105	48.95	59.56	10.46	22.16	35.98	4.49	102.24	102.51	102.77	102.24	102.51	102.77	11.39	502.33	525.70	549.20	620.23	643.61	667.10	112.90	45.10	105
104	47.81	58.51	10.23	22.88	36.56	4.65	101.00	101.25	101.50	101.00	102.25	101.50	11.34	497.30	520.35	543.52	616.04	639.10	662.26	112.90	43.60	104
103	46.70	57.48	9.99	23.62	37.16	4.81	99.79	100.02	100.25	99.79	100.02	100.25	11.29	492.50	515.24	538.06	612.10	634.83	657.68	113.00	42.20	103
102	45.81	56.48	9.76	24.36	37.77	4.98	98.60	98.81	99.02	98.60	98.81	99.02	11.25	487.92	510.35	532.88	608.39	630.82	653.34	113.10	40.80	102
101	44.54	55.49	9.54	25.10	38.39	5.15	97.44	97.63	97.83	97.44	97.63	97.83	11.21	483.57	505.69	527.91	604.91	627.04	649.25	113.10	39.40	101
100	43.50	54.54	9.31	25.86	39.02	5.35	96.30	96.47	96.65	96.30	96.47	96.65	11.17	479.42	501.26	523.16	601.66	623.49	645.40	113.10	37.90	100
99	42.47	53.60	9.09	26.63	39.66	5.50	95.18	95.34	95.50	95.18	95.34	95.50	11.14	475.49	497.03	518.64	598.63	620.17	641.78	113.20	36.30	99
98	41.46	52.68	8.87	27.41	40.31	5.68	94.09	94.23	94.37	94.09	94.23	94.37	11.11	471.77	493.02	514.34	595.83	617.08	638.39	113.20	34.90	98
97	40.47	51.78	8.65	28.19	40.98	5.86	93.10	93.13	93.26	93.01	93.13	93.26	11.08	468.25	489.22	510.24	593.24	614.21	635.23	113.20	33.50	97
96	39.50	50.90	8.44	28.99	41.66	6.04	91.96	92.06	92.17	91.96	92.06	92.17	11.06	464.93	485.62	506.36	590.86	611.56	632.29	113.30	32.40	96
95	38.64	50.04	8.22	29.79	42.35	6.22	90.92	91.01	91.10	90.92	91.01	91.10	11.04	461.80	482.21	502.68	588.70	609.12	629.58	113.30	31.00	95
94	37.60	49.20	8.01	30.61	43.05	6.41	89.90	89.97	90.04	89.90	89.97	90.04	11.03	458.87	479.02	499.20	586.74	606.89	627.07	113.30	29.40	94
93	36.68	48.38	7.80	31.44	43.77	6.60	88.90	88.96	89.01	88.90	88.96	89.01	11.02	456.12	476.01	495.91	584.99	604.88	624.79	113.40	28.00	93
92	35.77	47.57	7.60	32.28	44.50	6.80	87.92	87.96	87.99	87.92	87.96	87.99	11.01	453.57	473.19	492.83	583.45	603.07	622.71	113.40	26.80	92
91	34.88	46.78	7.39	33.14	45.24	6.99	86.96	86.97	86.99	88.96	88.94	88.93	11.00	451.20	470.56	489.94	586.57	606.29	626.01	113.40	27.90	91
90	34.00	46.00	7.19	34.00	46.00	7.19	86.00	86.00	86.00	90.00	90.00	90.00	11.00	449.01	468.12	487.23	589.85	609.85	629.85	113.40	29.30	90
89	33.14	45.24	6.99	34.88	46.78	7.39	85.07	85.05	85..04	91.06	91.07	91.09	11.00	447.01	465.87	484.72	593.33	613.61	633.90	113.40	30.60	89
88	32.28	44.50	6.80	35.77	47.57	7.60	84.15	84.12	84.08	92.13	92.16	92.20	11.01	445.18	463.80	482.40	597.03	617.58	638.16	113.30	32.00	88
87	31.44	43.77	6.60	36.68	48.38	7.80	83.24	83.19	83.14	93.22	93.27	93.33	11.02	443.54	461.91	480.26	600.93	621.77	642.64	113.30	33.40	87
86	30.61	43.05	6.41	37.60	49.20	8.01	83.30	83.37	83.44	94.33	94.40	94.47	11.03	444.20	462.79	481.60	605.04	626.18	647.34	113.30	34.80	86
85	29.79	42.35	6.22	38.64	50.04	8.22	84.42	84.51	84.59	95.46	95.55	95.64	11.04	447.35	466.32	485.34	609.37	630.80	652.27	113.30	36.20	85
84	28.99	41.66	6.04	39.50	50.90	8.44	85.55	85.65	85.76	96.61	96.72	96.82	11.06	450.69	469.96	489.27	613.92	635.65	657.42	113.30	37.60	84
83	28.19	40.98	5.86	40.47	51.78	8.65	86.70	86.82	86.94	97.78	97.90	98.03	11.08	454.22	473.79	493.41	618.70	640.72	662.81	113.30	39.00	83
82	27.41	40.31	5.68	41.46	52.68	8.87	87.87	88.01	88.15	98.97	99.11	99.26	11.11	457.95	477.82	497.75	623.70	646.03	668.43	113.30	40.40	82
81	26.63	39.66	5.50	42.47	53.60	9.09	89.05	89.21	89.37	100.19	100.35	100.51	11.14	461.88	482.05	502.30	628.93	651.58	674.30	113.20	41.80	81
80	25.86	39.02	5.35	43.50	54.54	9.31	90.26	90.44	90.61	101.43	101.61	101.78	11.17	466.00	486.49	507.06	634.40	657.37	680.42	113.20	43.20	80
79	25.10	38.39	5.15	44.54	55.49	9.54	91.49	91.68	91.88	102.69	102.89	103.08	11.21	470.34	491.15	512.04	640.11	663.40	686.78	113.10	44.60	79
78	24.36	37.77	4.98	45.61	56.48	9.76	92.74	92.95	93.16	103.96	104.20	104.41	11.25	474.89	496.02	517.24	646.07	669.69	693.41	113.00	46.10	78
77	23.62	37.16	4.81	46.70	57.48	9.99	94.01	94.24	94.47	105.30	105.53	105.76	11.29	479.66	501.11	522.67	652.78	676.24	700.31	113.00	47.50	77
76	22.88	36.56	4.65	47.81	58.51	10.23	95.31	95.56	95.81	106.64	106.89	107.14	11.34	484.65	506.44	528.34	658.75	683.06	707.48	113.00	49.00	76
75	22.16	35.98	4.49	48.95	59.56	10.46	96.63	96.90	97.17	108.02	108.29	108.55	11.39	489.87	511.99	534.24	665.50	690.16	714.94	112.90	50.50	75
74	21.44	35.40	4.33	50.11	60.64	10.70	97.98	98.26	98.55	109.42	109.71	110.00	11.44	495.32	517.79	540.39	672.52	697.54	722.68	112.80	52.00	74
73	20.72	34.84	4.17	51.30	61.74	10.94	99.36	99.66	99.97	110.86	111.16	111.47	11.50	501.01	523.84	546.80	679.82	705.21	730.72	112.80	53.50	73
72	20.02	34.28	4.02	52.51	62.88	11.18	100.76	101.08	101.41	112.33	112.65	112.98	11.57	506.96	530.14	553.47	687.42	713.18	739.08	112.70	55.00	72
71	19.32	33.74	3.86	53.75	64.04	11.42	102.20	102.54	102.88	113.83	114.17	114.52	11.63	513.16	536.71	560.42	695.32	721.46	747.75	112.60	56.60	71
70	18.63	33.20	3.72	55.02	65.23	11.66	103.66	104.03	104.39	115.37	115.73	116.10	11.71	519.62	543.55	567.64	703.54	730.07	756.76	112.50	58.10	70

LEGEND

α = ANGLE OF TURN

The angle through which a vehicle travels on the public road approach toward making a right hand turn. It is measured from the extension of the tangent on which a vehicle approaches the intersecting road to the corresponding tangent on the intersecting road to which the vehicle turns.

β = INTERSECTION CONTROL ANGLE



NOTES :

1. See Standard Drawing E 610-PRAP-02 for public road approach type A.
2. See Standard Drawing E 610-PRAP-03 for public road approach type B.
3. See Standard Drawing E 610-PRAP-04 for General Notes.

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH TYPE A & TYPE B – TABLE OF VALUE

SEPTEMBER 2001

STANDARD DRAWING NO. **E 610-PRAP-05**

ANTHONY L. UREMOVICH REGISTERED No. 18095 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

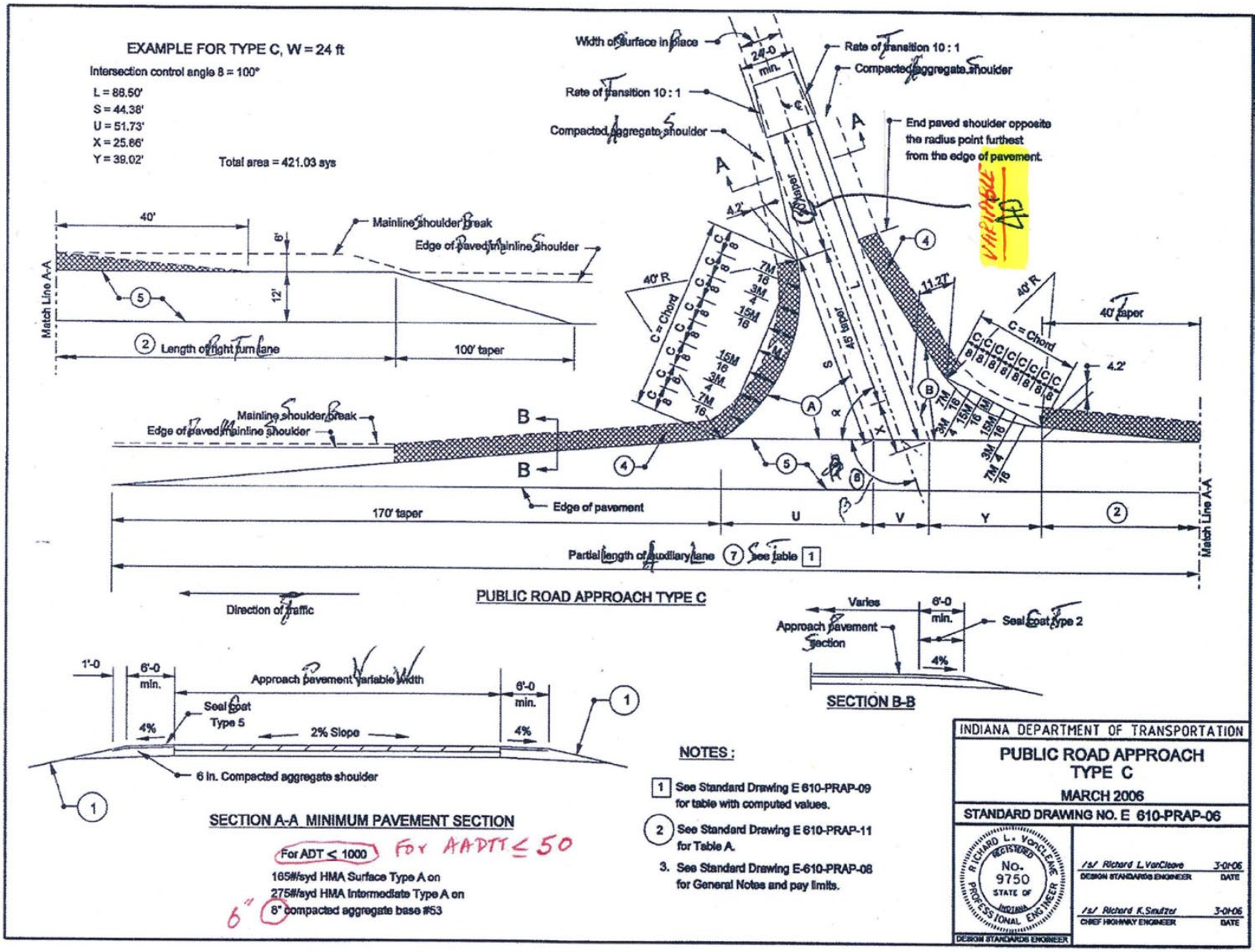
/s/ Anthony L. Uremovich 9-04-01
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 9-04-01
CHIEF HIGHWAY ENGINEER DATE

Item No. 04 01/21/10 (2010 SS)
Mr. Andrewski
Date: 01/21/10

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

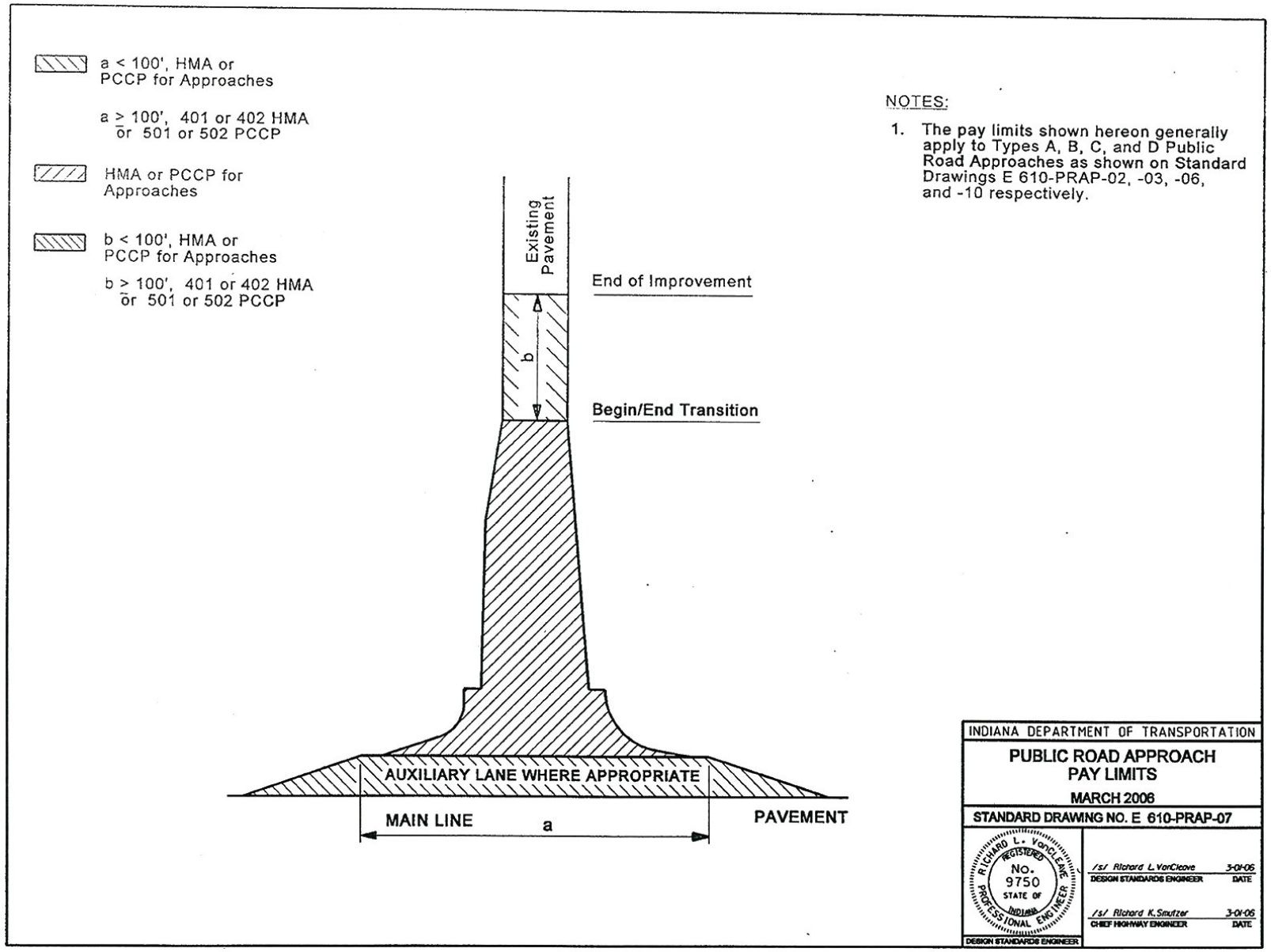
PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-06 PUBLIC ROAD APPROACH TYPE C



Item No. 04 01/21/10 (2010 SS)
Mr. Andrewski
Date: 01/21/10

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-07 PUBLIC ROAD APPROACH PAY LIMITS



Item No. 04 01/21/10 (2010 SS)
Mr. Andrewski
Date: 01/21/10

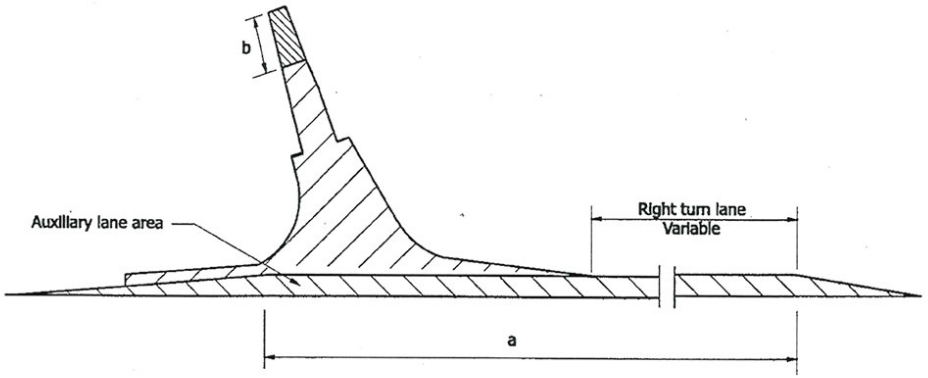
REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-08 PUBLIC ROAD APPROACH TYPE C – GENERAL NOTES

GENERAL NOTES

These notes are for Standard Drawings E 610-PRAP-06 and E 610-PRAP-09.

1. See table on Standard Drawing E 610-PRAP-04 for embankment slopes to be built on either side of the approach.
2. Cross culverts under the public road approach which cannot be located outside the mainline clear zone will require appropriate end treatments at each end as shown on the plans.
3. If the approach is to be constructed of concrete, the details shall be as shown elsewhere in the plans for pavement thickness, joint type, and location.
4. The cross hatched ▨ shoulder area indicates the limits where the shoulder is the same section as the approach pavement.
5. The pavement section for the auxiliary lane shall be as detailed elsewhere in the plans.
6. If the ADT for the public road is greater than 1000, the required pavement section shall be as shown elswhere in the plans.
7. See Standard Drawing E 610 - PRAP - 07 for pay limit details.



PAY LIMITS

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH
TYPE C - GENERAL NOTES

SEPTEMBER 2007

STANDARD DRAWING NO. E 610-PRAP-08

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/04/07
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/04/07
CHIEF HIGHWAY ENGINEER DATE

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

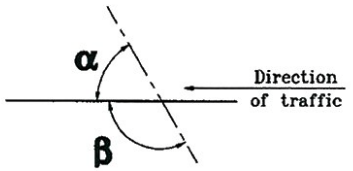
PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-09 PUBLIC ROAD APPROACH TYPE C – TABLE OF VALUES

β	L	S	U	X	Y	V	Shoulder gap	Chord		M		Approach Areas			Auxiliary lane part.area	β
								Lt.	Rt.	Lt.	Rt.	Ⓐ	Ⓑ	Total	⑦	
degree	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	sys.	sys.	sys.	sys.	degree
110	98.95	54.59	61.38	18.63	33.20	25.54	330.12	63.16	33.68	15.45	3.72	116.48	85.95	466.32	326.83	110
109	97.59	53.46	60.31	19.32	33.74	25.38	329.43	62.72	34.31	15.17	3.86	112.89	87.65	460.78	325.90	109
108	96.26	52.36	59.26	20.02	34.28	25.24	328.78	62.29	34.94	14.90	4.02	109.42	89.37	455.49	325.04	108
107	94.95	51.28	58.24	20.72	34.84	25.10	328.18	61.85	35.56	14.63	4.17	106.08	91.14	450.43	324.23	107
106	93.68	50.23	57.24	21.44	35.40	24.97	327.61	61.40	36.19	14.36	4.33	102.85	92.95	445.59	323.48	106
105	92.42	49.21	56.27	22.16	35.98	24.85	327.10	60.95	36.81	14.09	4.49	99.72	94.80	440.98	322.79	105
104	91.19	48.20	55.32	22.88	36.56	24.74	326.62	60.50	37.43	13.83	4.65	96.70	96.70	436.58	322.16	104
103	89.99	47.22	54.39	23.62	37.16	24.63	328.18	60.04	38.04	13.56	4.81	93.79	98.65	432.39	321.58	103
102	88.60	46.25	53.48	24.36	37.77	24.54	325.79	60.58	38.66	13.30	4.98	90.96	100.64	428.41	321.05	102
101	87.64	45.31	52.60	25.10	38.39	24.45	325.44	59.11	39.27	13.04	5.15	88.24	102.68	424.62	320.58	101
100	86.50	44.38	51.73	25.86	39.02	24.37	325.12	58.64	39.87	12.79	5.32	85.60	104.77	421.03	320.16	100
99	85.37	43.47	50.88	26.63	39.66	24.30	324.84	58.16	40.48	12.53	5.50	83.05	108.92	417.63	319.79	99
98	84.27	42.58	50.05	27.41	40.31	24.24	324.60	57.68	41.08	12.28	5.68	80.58	109.12	414.41	319.47	98
97	83.18	41.71	49.24	28.19	40.98	24.18	324.40	57.19	41.68	12.03	5.86	78.19	111.38	411.38	319.20	97
96	82.11	40.85	48.45	28.99	41.66	24.13	324.24	56.70	42.27	11.78	6.04	76.87	113.70	408.53	318.98	96
95	81.06	40.01	47.67	29.79	42.35	24.09	324.11	56.21	42.86	11.54	6.22	73.63	116.07	405.86	318.81	95
94	80.02	39.16	46.90	30.61	43.05	24.06	324.01	56.71	43.45	11.29	6.41	71.47	118.51	403.36	318.68	94
93	79.00	38.37	46.16	31.44	43.77	24.03	323.96	55.20	44.03	11.05	6.60	69.37	121.02	401.04	318.61	93
92	77.98	37.57	45.42	32.28	44.50	24.02	323.94	54.70	44.62	10.81	6.80	67.33	123.59	398.88	318.58	92
91	77.92	36.79	44.70	33.14	45.24	24.00	323.94	54.18	45.19	10.57	6.99	65.36	126.23	399.40	318.60	91
90	79.00	36.00	44.00	34.00	46.00	24.00	324.00	53.67	48.77	10.34	7.19	63.48	128.84	403.07	318.67	90
89	80.09	35.24	43.31	34.88	46.78	24.00	324.09	53.15	46.34	10.10	7.39	61.61	131.73	406.91	318.79	89
88	81.19	34.49	42.63	35.77	47.57	24.02	324.22	52.63	46.90	9.87	7.60	59.82	134.60	410.93	318.96	88
87	82.31	33.75	41.96	36.68	48.38	24.03	324.37	52.10	47.47	9.64	7.80	58.08	137.54	415.12	319.17	87
86	83.44	33.03	41.31	37.60	49.20	24.06	324.57	51.57	48.03	9.42	8.01	58.40	140.57	419.49	319.43	86
85	84.59	32.31	40.67	38.54	50.04	24.09	324.80	51.03	48.58	9.20	8.22	54.77	143.68	424.04	319.74	85
84	85.76	31.60	40.04	39.50	50.09	24.13	325.07	50.49	49.14	8.97	8.44	53.20	146.88	428.77	320.10	84
83	86.94	30.94	39.42	40.47	51.78	24.18	325.38	49.95	49.69	8.75	8.65	51.67	150.18	433.69	320.51	83
82	88.15	30.21	38.81	41.46	52.68	24.24	325.73	49.40	50.23	8.54	8.87	50.18	153.57	438.81	320.97	82
81	89.37	29.54	38.21	42.47	53.60	24.30	326.11	48.85	50.77	8.32	9.09	48.74	157.06	444.12	321.48	81
80	90.61	28.86	37.63	43.50	54.54	24.37	326.54	48.30	51.31	8.11	9.31	47.35	160.66	449.04	322.04	80
79	91.88	28.20	37.05	44.54	55.49	24.45	326.99	47.74	51.84	7.90	9.54	46.00	164.36	455.36	322.65	79
78	93.16	27.55	36.48	45.61	56.48	24.54	327.50	47.17	52.38	7.69	9.76	44.69	168.17	461.29	323.32	78
77	94.47	26.90	35.92	46.70	57.48	24.63	328.30	46.61	52.90	7.49	9.99	43.42	172.10	467.44	324.04	77
76	95.81	26.26	35.37	47.81	58.51	24.74	328.82	46.04	53.42	7.29	10.23	42.18	176.15	473.82	324.82	76
75	97.17	25.63	35.83	48.95	59.56	24.85	328.24	45.47	53.94	7.09	10.46	40.99	180.33	480.43	325.65	75
74	98.55	25.00	34.30	50.11	60.64	24.97	329.91	44.89	54.45	6.89	10.70	39.83	184.64	487.28	326.54	74
73	99.97	24.38	33.78	51.30	61.74	25.10	330.62	44.31	54.96	6.70	10.94	38.71	189.08	494.37	327.49	73
72	101.41	23.77	33.27	52.51	62.88	25.24	331.39	43.73	55.47	6.50	11.18	37.62	193.67	501.72	328.50	72
71	102.88	23.16	32.76	53.75	64.04	25.38	332.18	43.14	55.97	6.32	11.42	36.56	198.41	509.33	329.58	71
70	104.39	22.56	32.26	55.06	65.23	25.54	333.03	42.55	56.47	6.13	11.66	35.54	203.30	517.21	330.71	70

LEGEND

α = ANGLE OF TURN
It is the angle which a vehicle travels on the public road approach toward making a right hand turn. It is measured from the extension of the tangent on which a vehicle approaches the intersecting road to the corresponding tangent on the intersecting road to which the vehicle turns.

β = INTERSECTION CONTROL ANGLE
$\beta = 180° - \alpha$



NOTES :

1. See Standard Drawing E 610-PRAP-06 for public road approach type C.
2. See Standard Drawing E 610-PRAP-08 for General Notes.

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH TYPE C – TABLE OF VALUES

SEPTEMBER 2001

STANDARD DRAWING NO. **E 610-PRAP-09**

ANTHONY L. UREMOVICH REGISTERED No. 18095 STATE OF INDIANA PROFESSIONAL ENGINEER

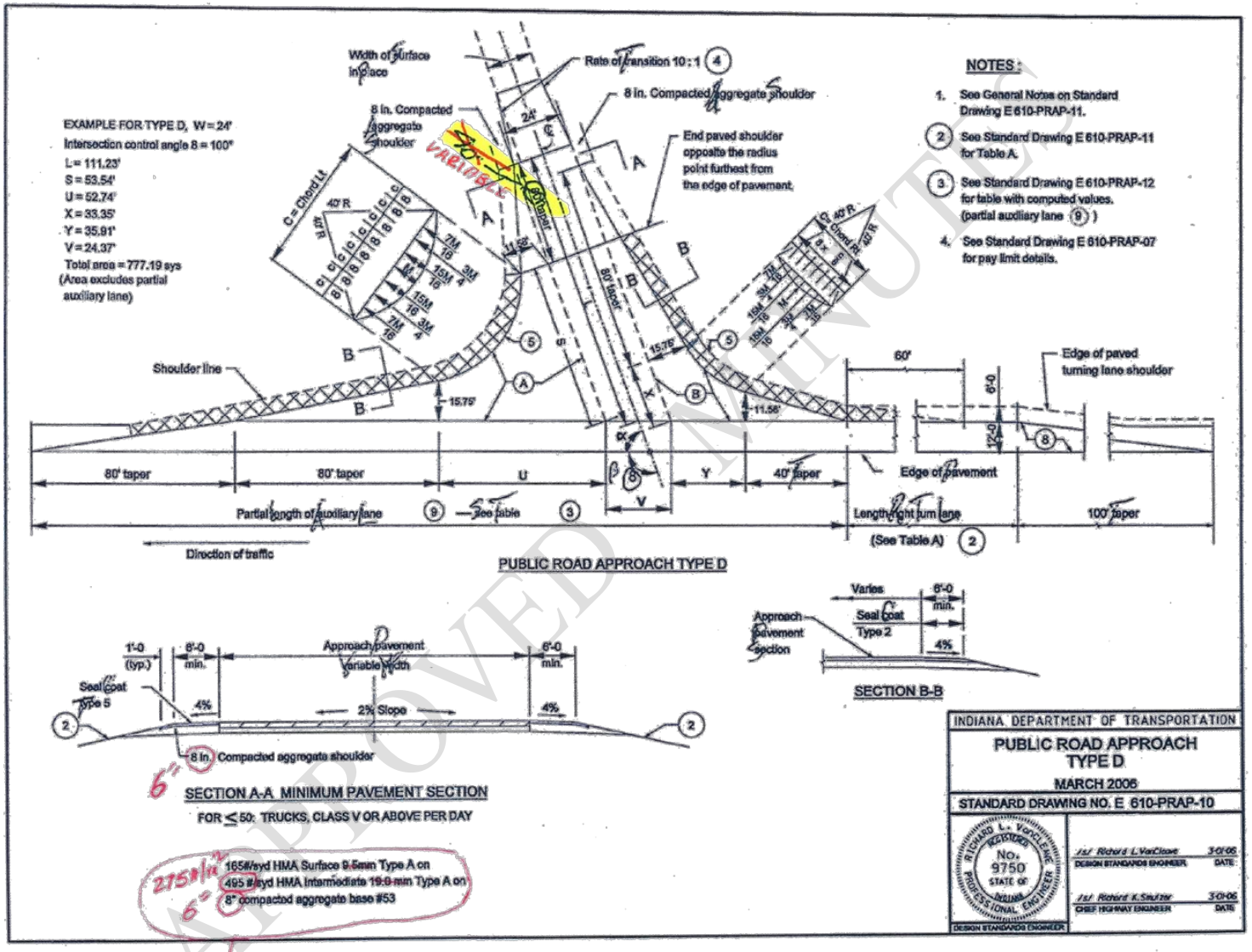
DESIGN STANDARDS ENGINEER

/s/ Anthony L. Uremovich 9-04-01
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 9-04-01
CHIEF HIGHWAY ENGINEER DATE

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-10 PUBLIC ROAD APPROACH TYPE D



APPROVED MINUTES

215#/sy 6" 165#/syd HMA Surface 9.5mm Type A on 495 #/syd HMA Intermediate 19.0 mm Type A on 8" compacted aggregate base #53

165 #/syd HMA, Surface, Type A on
275#/syd HMA, Intermediate, Type A on
6" Compacted Aggregate, No. 53, Base on
Subgrade Treatment

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-11 PUBLIC ROAD APPROACH TYPE D GENERAL NOTES AND TABLE A

GENERAL NOTES

These notes are for Standard Drawings E 610-PRAP-10 and E 610-PRAP-12.

1. Standard Drawings E 610-PRAP-10 and -12 are for intersection control angle 70° to 110° .
If intersection control angle is less than 70° or greater than 110° a special design will be required.

(2) See table on Standard Drawing E 610-PRAP-04 for embankment slopes to be built on either side of the approach

3. Cross culverts under the public road approach which cannot be located outside the mainline clear zone will require an appropriate end section at each end.

(4) If the existing pavement is asphalt the transition area shall be the same section as the approach and will be included in the pay limits for HMA for Approaches.

(5) The cross hatched ⊠⊠⊠ shoulder area indicates the limits where the shoulder is the same as the approach pavement.

6. If the approach is to be constructed of PCCP, the details shall be as shown elsewhere in the plans for pavement thickness, joint type, and location.

7. If the Class V or above truck count for the public road approach is greater than 50 per day, the required pavement section shall be as provided elsewhere in the plans

(8) The pavement section for the turn lane shall be as shown elsewhere in the plans.

TABLE A

MINIMUM LENGTH OF TURNING LANES (excluding taper) , ft.

Design speed	Downgrade slope in %					Upgrade slope in %				
(m.p.h.)	6 to 5	4.99 to 4	3.99 to 3	2.99 to 2.01	2 to 0	0 to 2	2.01 to 2.99	3 to 3.99	4 to 4.99	5 to 6
40	400	380	355	325	295	295	280	265	250	235
50	550	520	485	445	405	405	385	365	345	325
60	675	640	600	555	500	500	475	450	425	400
65	730	690	650	595	540	540	515	485	460	435
70	800	755	710	650	590	590	560	530	505	475

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH TYPE D
GENERAL NOTES AND TABLE A

SEPTEMBER 2007

STANDARD DRAWING NO. E 610-PRAP-11

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/04/07
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/04/07
CHIEF HIGHWAY ENGINEER DATE

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 610-PRAP-12 PUBLIC ROAD APPROACH TYPE D – TABLE OF VALUES

β degree	L ft	S ft	U ft	X ft	Y ft	V ft	Shoulder gap ft	Chord Lt. ft	Chord Rt. ft	M Lt. ft	M Rt. ft	Approach Areas (A) sys	Approach Areas (B) sys	Approach Areas Total sys	Auxiliary lane part.area (9) sys	β degree
110	109.97	65.61	65.50	25.46	29.21	25.54	320.25	52.66	29.14	9.98	2.75	335.88	174.50	803.64	373.67	110
109	108.40	64.26	64.09	26.22	29.83	25.38	319.31	52.34	29.79	9.75	2.88	329.40	176.97	795.42	372.41	109
108	106.85	62.98	62.72	26.97	30.46	25.24	318.41	51.81	30.43	9.52	3.01	323.11	179.49	787.55	371.22	108
107	105.35	61.68	61.37	27.74	31.11	25.10	317.57	51.27	31.08	9.30	3.14	317.01	182.07	780.00	370.10	107
106	105.08	60.43	60.06	28.52	31.76	24.97	316.78	50.73	31.72	9.07	3.28	311.08	184.70	775.99	369.04	106
105	106.08	59.22	58.77	29.30	32.42	24.85	316.04	50.19	32.36	8.85	3.42	305.33	187.38	775.60	368.06	105
104	107.10	58.03	57.52	30.09	33.10	24.73	315.35	49.65	33.00	8.63	3.56	299.74	190.12	775.45	367.13	104
103	108.12	56.87	56.28	30.89	33.78	24.63	314.70	49.10	3.63	8.42	3.71	294.31	192..92	775.54	366.26	103
102	109.15	55.74	55.08	31.70	34.48	24.54	314.10	48.54	34.26	8.21	3.85	289.03	195.78	775.87	365.46	102
101	110.18	54.63	53.90	32.52	35.19	24.45	313.54	47.99	34.89	8.00	4.01	283.89	198.70	776.42	364.72	101
100	111.23	53.54	52.74	33.35	35.91	24.37	313.02	47.43	35.52	7.79	4.16	278.90	201.68	777.19	364.03	100
99	112.28	52.48	51.61	34.18	36.65	24.30	312.55	46.86	36.14	7.58	4.32	274.04	204.73	778.19	363.40	99
98	113.35	51.45	50.49	35.03	37.39	24.24	312.12	46.30	36.77	7.38	4.47	269.31	207.85	779.42	362.83	98
97	114.42	50.43	49.40	35.89	38.15	24.18	311.73	45.72	37.38	7.18	4.64	264.70	211.04	780.86	362.31	97
96	115.51	49.44	48.33	36.77	38.93	24.13	311.39	45.15	38.00	6.98	4.80	260.21	214.31	782.53	361.85	96
95	116.60	48.46	47.27	37.65	39.71	24.09	311.08	44.57	38.61	6.78	4.97	255.84	217.65	784.42	361.44	95
94	117.71	47.51	46.24	38.55	40.52	24.06	310.82	43.99	39.22	6.59	5.14	251.58	221.01	786.54	361.09	94
93	118.83	46.57	45.22	39.46	41.33	24.03	310.59	43.41	39.83	6.40	5.31	247.43	224.56	788.87	360.79	93
92	119.96	45.66	44.22	40.38	42.17	24.01	310.40	42.82	40.43	6.21	5.48	243.38	228.15	791.43	360.54	92
91	121.11	44.76	43.24	41.32	43.01	24.00	310.26	42.23	41.03	6.03	5.66	239.43	231.82	794.21	360.34	91
90	122.27	43.88	42.27	42.27	43.88	24.00	310.15	41.63	41.63	5.84	5.84	235.58	235.58	797.21	360.20	90
89	123.45	43.01	41.32	43.24	44.76	24.00	310.08	41.03	42.23	5.66	6.03	231.82	239.43	800.44	360.11	89
88	124.64	42.17	40.38	44.22	45.66	24.01	310.06	40.43	42.82	5.48	6.21	228.15	243.38	803.90	360.07	88
87	125.85	41.33	39.46	45.22	46.57	24.03	310.07	39.83	43.41	5.31	6.40	224.56	247..38	807.60	360.09	87
86	127.08	40.52	38.55	46.24	47.51	24.06	310.12	39.22	43.99	5.14	6.59	221.06	251.56	811.52	360.16	86
85	128.32	39.71	37.65	47.27	48.46	24.09	310.21	38.61	44.57	4.97	6.78	217.65	255.84	815.69	360.28	85
84	129.59	38.93	36.77	48.33	49.44	24.13	310.34	38.00	45.15	4.80	6.98	214.31	260.21	820.09	360.45	84
83	130.87	38.15	35.89	49.40	50.43	24.18	310.51	37.38	45.72	4.64	7.18	211.04	264.70	824.74	360.67	83
82	132.18	37.39	35.03	50.49	51.45	24.24	310.72	36.77	46.30	4.47	7.38	207.85	269.31	829.64	360.95	82
81	133.51	36.65	34.18	51.61	52.48	24.30	310.97	36.14	46.86	4.32	7.58	204.73	274.04	834.79	361.29	81
80	134.86	35.91	33.35	52.74	53.54	24.37	311.26	35.52	47.43	4.16	7.79	201.68	276.90	840.20	361.68	80
79	136.23	35.19	32.52	53.90	54.63	24.45	311.59	34.89	47.99	4.01	8.00	198.70	283.89	845.87	362.12	79
78	137.63	34.48	31.70	55.08	55.74	24.54	311.97	34.26	48.54	3.85	8.21	195.78	289.03	851.82	362.63	78
77	139.06	33.78	30.89	56.28	56.87	24.63	312.39	33.63	49.10	3.71	8.42	192.92	294.31	858.04	363.19	77
76	140.51	33.10	30.09	57.52	58.03	24.73	312.85	33.00	49.65	3.56	8.63	190.12	299.74	864.55	363.80	76
75	141.99	32.42	29.30	58.77	59.22	24.85	313.36	32.36	50.19	3.42	8.85	187.38	305.33	871.35	364.48	75
74	143.50	31.76	28.52	60.06	60.43	24.97	313.92	31.72	50.73	3.28	9.07	184.70	311.08	878.44	365.22	74
73	145.04	31.11	27.74	61.37	61.68	25.10	313.92	31.08	51.27	3.14	9.30	182.07	317.01	885.85	366.02	73
72	146.61	30.46	26.97	62.72	62.96	25.24	315.17	30.43	51.81	3.01	9.52	179.49	323.11	893.57	366.89	72
71	148.22	29.83	26.22	64.09	64.26	25.38	315.86	29.79	52.34	2.88	9.75	176.97	329.40	901.63	367.82	71
70	149.87	29.21	25.46	65.50	65.61	25.54	316.61	29.14	52.86	2.75	9.99	174.50	335.88	910.02	368.81	70

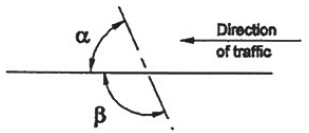
LEGEND

α = ANGLE OF TURN

The angle which a vehicle travels on the public road approach toward making a right hand turn. It is measured from the extention of the tangent on which a vehicle approaches the intersecting road to the corresponding tangent on the intersecting road to which the vehicle turns.

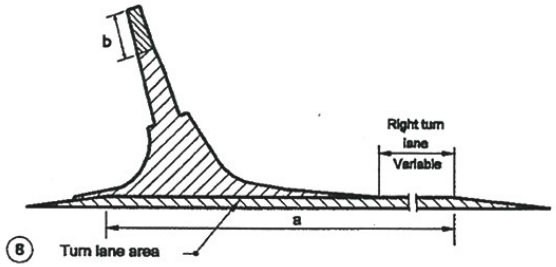
β = INTERSECTION CONTROL ANGLE

β = 180°- α



NOTES:

1. See Standard Drawing E 610-PRAP-10 for public road approach type D.
2. See Standard Drawing E 610-PRAP-11 for General Notes.



INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH TYPE D - TABLE OF VALUES

MARCH 2006

STANDARD DRAWING NO. E 610-PRAP-12

R. RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER
DESIGN STANDARDS ENGINEER

/s/ Richard L VanCleave 3-01-06
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 3-01-06
CHIEF HIGHWAY ENGINEER DATE

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO STANDARD DRAWING E 713-TCTR-04 TEMPORARY RUNAROUND GENERAL NOTES

GENERAL NOTES

1. The pavement section for ~~traffic volumes or percent trucks~~ exceeding the values shown in (S) in the Legend shall be as shown elsewhere in the plans.

2. ~~The surface course shall be placed when the runaround is in service between December 1 and the following April 1.~~ Maintenance Agreement

3. A temporary bridge or temporary pipe shall be used as specified. A 28'-0 clear roadway width shall be provided on a temporary bridge.

(4) The connection of the temporary runaround to the existing pavement shall be outside the limits of the approach pavement removal.

(5) Temporary pavement markings will be required as shown. The contractor shall have the option of using temporary tape or paint for all temporary pavement markings except where otherwise specified.

(6) Delineators type D-2 (white) shall be placed at 30 ft maximum spacing on both sides throughout the length of the temporary runaround, including across the temporary structure. If a temporary bridge is used, type 3 object markers shall be placed at all four corners in accordance with the MUTCD.

(7) Spacing of drums at this location shall be 20 ft.

(8) If the runaround posted speed limit is greater than 30 mph the reverse curve sign, XW1-4-A, shall be used at this location.
If the runaround posted advisory speed limit is 30 mph or less, the reverse turn sign, XW1-3-A shall be used.

LEGEND

Delineator type D-2 (white)

(S) Pavement section for ADT ∠ 4500 and maximum of 10% trucks shall be:
140#/yd² HMA Surface 9.5 mm
630#/yd² HMA intermediate 19.0 mm
6 in. compacted aggregate base, size No. 53
(See Genaral Notes 1 and 2.)

(S) Pavement section for truck count, AADTT < 500 shall be
165 #/yd² HMA Surface, Type A, on
275 #/yd² HMA Intermdiate, Type A, on
6 in. Compacted Aggregate, size No. 53, Base, on
Type III Subgrade Treatment
(See Genaral Notes 1)

INDIANA DEPARTMENT OF TRANSPORTATION
TEMPORARY RUNAROUND GENERAL NOTES
JANUARY 1999
STANDARD DRAWING NO. E 713-TCTR-04

ANTHONY L. UREMOVICH REGISTERED No. 18095 STATE OF INDIANA PROFESSIONAL ENGINEER
DESIGN STANDARDS ENGINEER

DETAILS PLACED IN THIS FORMAT 11-15-99
/s/ Anthony L. Uremovich 11-15-99
DESIGN STANDARDS ENGINEER DATE
/s/ Firooz Zandi 11-15-99
CHIEF HIGHWAY ENGINEER DATE
ORIGINALLY APPROVED 1-04-99

REVISION TO STANDARD DRAWINGS AND DESIGN MANUAL

PROPOSED REVISION TO DESIGN MANUAL SECTION 82-6.04 RUNAROUND OR DETOUR

82-6.04 Runaround or Detour

In addition to the criteria shown on the INDOT *Standard Drawings*, a temporary runaround or specially-built detour should satisfy the geometric and roadside-safety criteria provided in Sections 82-3.0 and 82-4.0.

The embankment for a temporary runaround should be shown on the mainline cross sections.

truck count, AADTT 500

If the ~~AADT is 5,000~~ or greater, ~~or if the percent trucks is 10% or greater,~~ a project-specific pavement design is required for a temporary runaround. See the INDOT *Standard Drawings* for the pavement section to be used if the ~~AADT is less than 5000, or if the percentage of trucks is less than 10%.~~

truck count, AADTT is less than 500,

> ** *PRACTICE POINTER* **
>
> Unofficial detour routes should not be shown on the plans or described in the special provisions.

A temporary runaround should be in accordance with the design criteria included herein. The following Level One elements should satisfy the criteria as follows.

	Element	Design Criterion
1.	Design speed	Section 82-3.01
2.	Lane width	Section 82-3.02
3.	Shoulder width	Section 82-3.02
4.	Bridge width	Standard Specifications Section 713.04
5.	Structural capacity	Standard Specifications Section 713.04
6.	Horizontal curvature	Figure 82-3A
7.	Superelevation transition length	Section 82-3.05 and Chapter 43
8a.	Stopping sight distance at horizontal curve	Section 82-3.04. Design speed should be used in the construction zone. Section 43-4.0
8b.	Stopping sight distance at vertical curve	Sag: Section 82-3.06; Crest: Section 82-3.04 and Chapter 44.
9.	Maximum grade	3R criteria for the design speed for the construction zone, appropriate functional classification, and rural or urban environment.
10.	Through lane cross slope	3R criteria for the appropriate functional classification and rural or urban environment. If the

COMMENTS AND ACTION

REVISION TO STANDARD DRAWING E 610-PRAP-02 THRU 12 PUBLIC ROAD
REVISION TO STANDARD DRAWING E 713-TCTR-04 TEMPORARY RUNAROUND
REVISION TO IDM SECTION 82-6.04 RUNAROUND OR DETOUR

Mr. Andrewski presented the need for the changes to this spec.
Mr. Cales stated that there was no way for the contractor or the PE/S to know what the AADTT was since that was not something posted on the title sheet of the plans.

It was noted that the traffic data for an approach was generally not put on the title sheet unless it was a "S" line. Mr. Andrewski stated that the designer would make the decision and cite the proper standard drawing if the traffic met the criteria. Mr. Cales then stated that if the designers needed this information that it should be with the design manual and not in construction documents. Mr. Capling er then stated that designers are going to start asking for more traffic data now because he felt this was not something that was being recorded.

Mr. Andrewski stated that the AADT and per cent trucks were known so AADTT is known.

Mr. Keefer asked if the reduction to 6 inches of aggregate and 4 inches of asphalt was enough material to hold up for the expected life of the pavement.

Mr. Miller also noted that if the surface course was left off until the end of the project, which is the standard practice, the pavement section would be very thin and the traffic would probably damage the approach. Mr. Andrewski stated it was the contractor's responsibility to maintain the road during the life of the project.

Mr. Pankow also noted that the temporary runaround was just 4 inches of asphalt on 6 inches of aggregate. Mr. Andrewski noted that when there is subgrade treatment under them, both the approaches and the temporary runaround will last for their expected duration, which is 20 years for the approaches and 1 season for the runaround.

Mr. Broz asked if a specific treatment could be listed on 713 -TCTR-04 because it was not on the approaches and all the revised pages should be kept as uniform as possible. Mr. Andrewski decided to use Type II IA for the approaches and Type III on the temporary runaround.

Mr. Wright asked if were then going to start putting the AADTT on the title sheet and the answer was no.

Mr. Cales suggested that the typical section A-A that is on every approach sheet be consolidated to 1 location.

COMMENTS AND ACTION (CONTINUED)

REVISION TO STANDARD DRAWING E 610-PRAP-02 THRU 12 PUBLIC ROAD
REVISION TO STANDARD DRAWING E 713-TCTR-04 TEMPORARY RUNAROUND
REVISION TO IDM SECTION 82-6.04 RUNAROUND OR DETOUR

Motion: Mr. Andrewski Second: Mr. Wright Ayes: 7 Nays: 2	Action: _____ Passed as Submitted __X__ Passed as Revised _____ Withdrawn
Standard Specifications Sections affected: Section 400	_____ 20__ Standard Specifications Book
Recurring Special Provision affected: None	_____ Create RSP (No._____) Effective _____Letting RSP Sunset Date: _____ _____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Standard Sheets affected: E 610-PRAP-02 THRU -12; E 713-TCTR-04	Standard Drawing Effective _____ __X__ Create RPD (No. _____) Effective Sept. 01, 2010 Letting
Design Manual Sections affected: Section 82-6.04	_____ Technical Advisory
GIFE Sections affected: Section 16	GIFE Update Req'd.? Y ___ N _X_ By _____ Addition or _____ Revision Frequency Manual Update Req'd? Y___N_X By _____ Addition or _____ Revision Received FHWA Approval? _x

SPECIFICATION REVISIONS

REVISION TO STANDARDS SPECIFICATION

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Cost Saving measures have been developed for PCCP

PROPOSED SOLUTION: Revise PCCP Typical Sections

APPLICABLE STANDARD SPECIFICATIONS: 500 Section

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: Chapter 52 Figures: 52-13F, 52-13G, 52-13H, 52-18P, & 52-13T

APPLICABLE SECTION OF GIFE: Sections 6, 7, & 8

APPLICABLE RECURRING SPECIAL PROVISIONS: None

Submitted By: David Andrewski

Title: Manager, Office of Pavement Engineering

Organization: INDOT

Phone Number: 317-232-5452

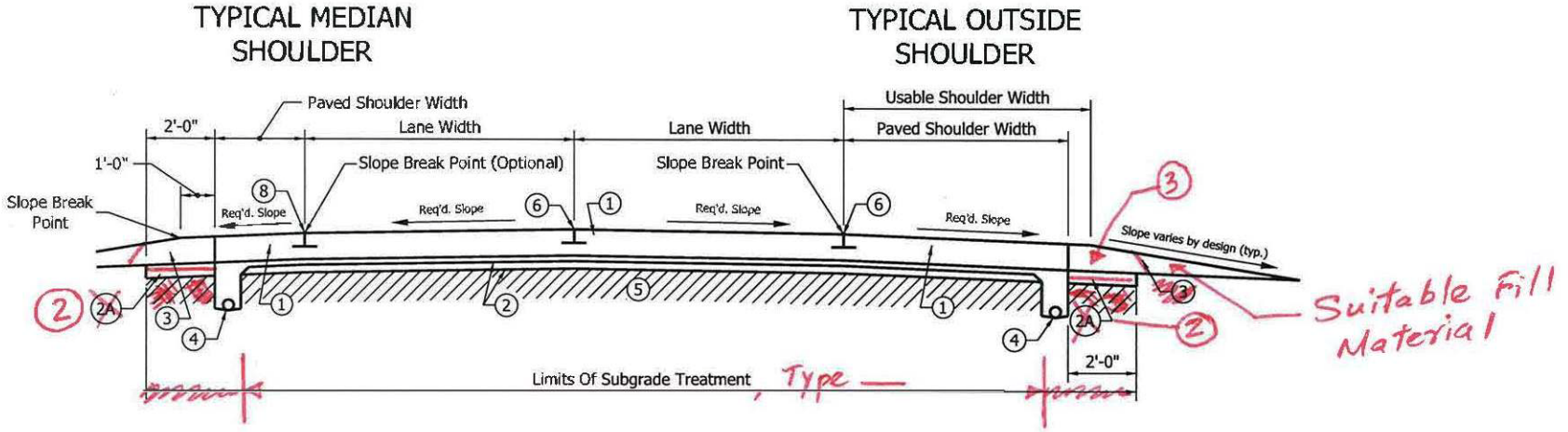
Date: December 17, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? Pavement Steering Committee and AdHoc Industry and INDOT Group.

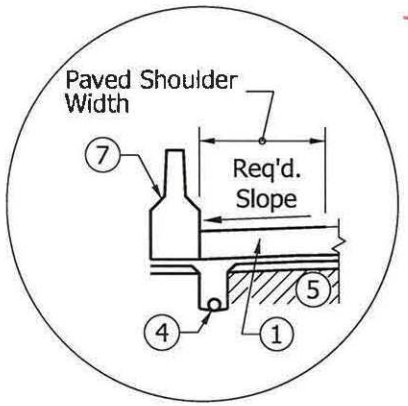
Item No. 05 01/21/10 (2010 SS)
Mr. Andrewski
Date: 01/21/10

REVISION TO STANDARDS SPECIFICATION

PROPOSED REVISION TO IDM FIGURE 52-13F PCCP SECTION WITH PCC SHOULDER



TYPICAL MEDIAN SHOULDER WITH BARRIER WALL



Mainline and Shoulders

1. PCCP
2. Subbase for PCCP (3 in. Coarse Aggregate No.8 On 6 in. Coarse Aggregate, Size No. 53)
2A. ~~6 in. Compacted Aggregate, Size No. 53~~
3. Variable-Depth Compacted Aggregate, Size No. 53
4. Pipe, Type 4, Circular, 6 in.
5. Subgrade Treatment, Type _____
6. Longitudinal Joint or Longitudinal Construction Joint. See Figure 52-13R for Pavement Joint Options.
7. Concrete Median Barrier
8. Longitudinal Joint or Longitudinal Construction Joint, or no Joint. See Figure 52-13R for Pavement-Joint Options.

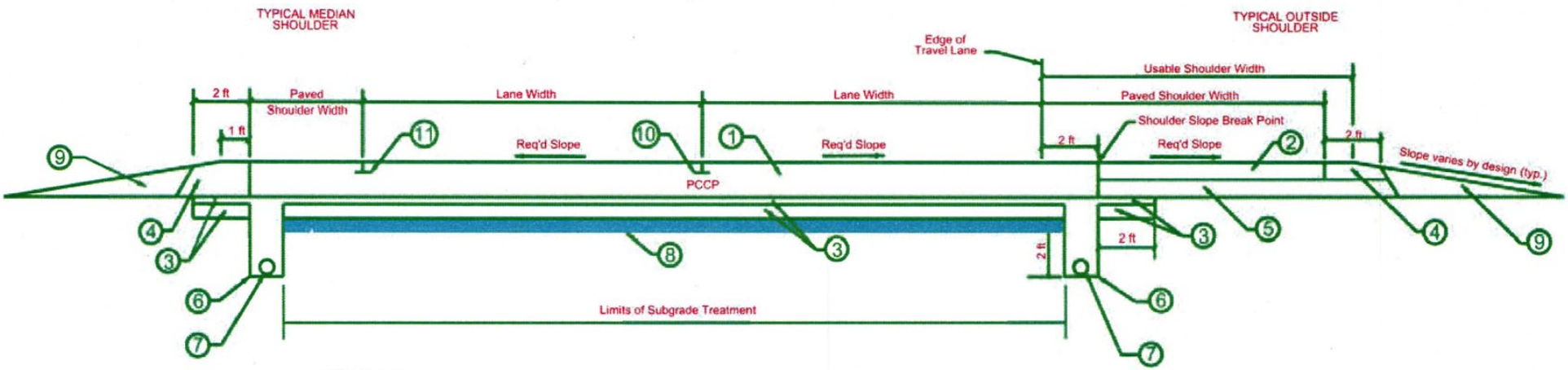
* Where underdrains are not required, Dense Graded Subbase should be used.

PCCP SECTION WITH PCC SHOULDER

Figure 52-13F

REVISION TO STANDARDS SPECIFICATION

PROPOSED REVISION TO IDM FIGURE 52-13G PCCP SECTION WITH HMA SHOULDER



① PCCP

• ② 165 lb/yd^2 HMA Surface 9.5mm
495 lb/yd^2 HMA Base 25.0mm

•• ③ Subbase for PCCP (3 in. Coarse Aggregate, No.8 on 6 in. Coarse Aggregate, No. 53)

④ Variable Depth Compacted Aggregate, No. 53

⑤ 6" Compacted Aggregate, No. 53, Base

⑥ Underdrain

⑦ Pipe, Type 4, Circular, 6 in.

⑧ Subgrade Treatment, Type ____

⑨ Suitable Fill Material

⑩ Longitudinal Joint or Longitudinal Construction Joint

⑪ Longitudinal Joint or Longitudinal Construction Joint, or no Joint.

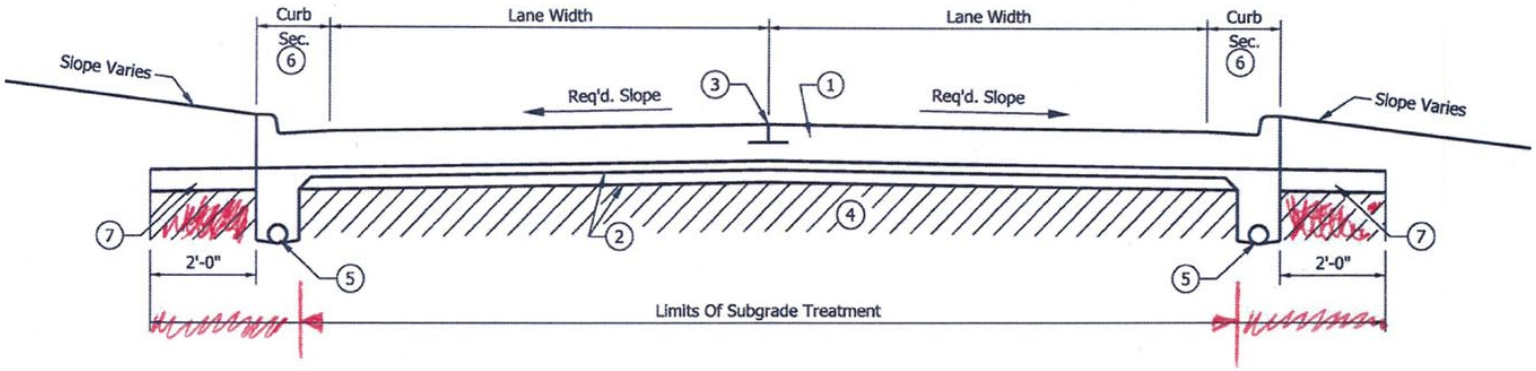
• See Section 52-9.02 to determine the appropriate HMA mixture designation.

•• Where underdrains are not required, Dense Graded Subbase should be used.

PCCP SECTION WITH HMA SHOULDER
Figure 52-13G

REVISION TO STANDARDS SPECIFICATION

PROPOSED REVISION TO IDM FIGURE 52-13H PCCP WITH CONCRETE CURB



Mainline

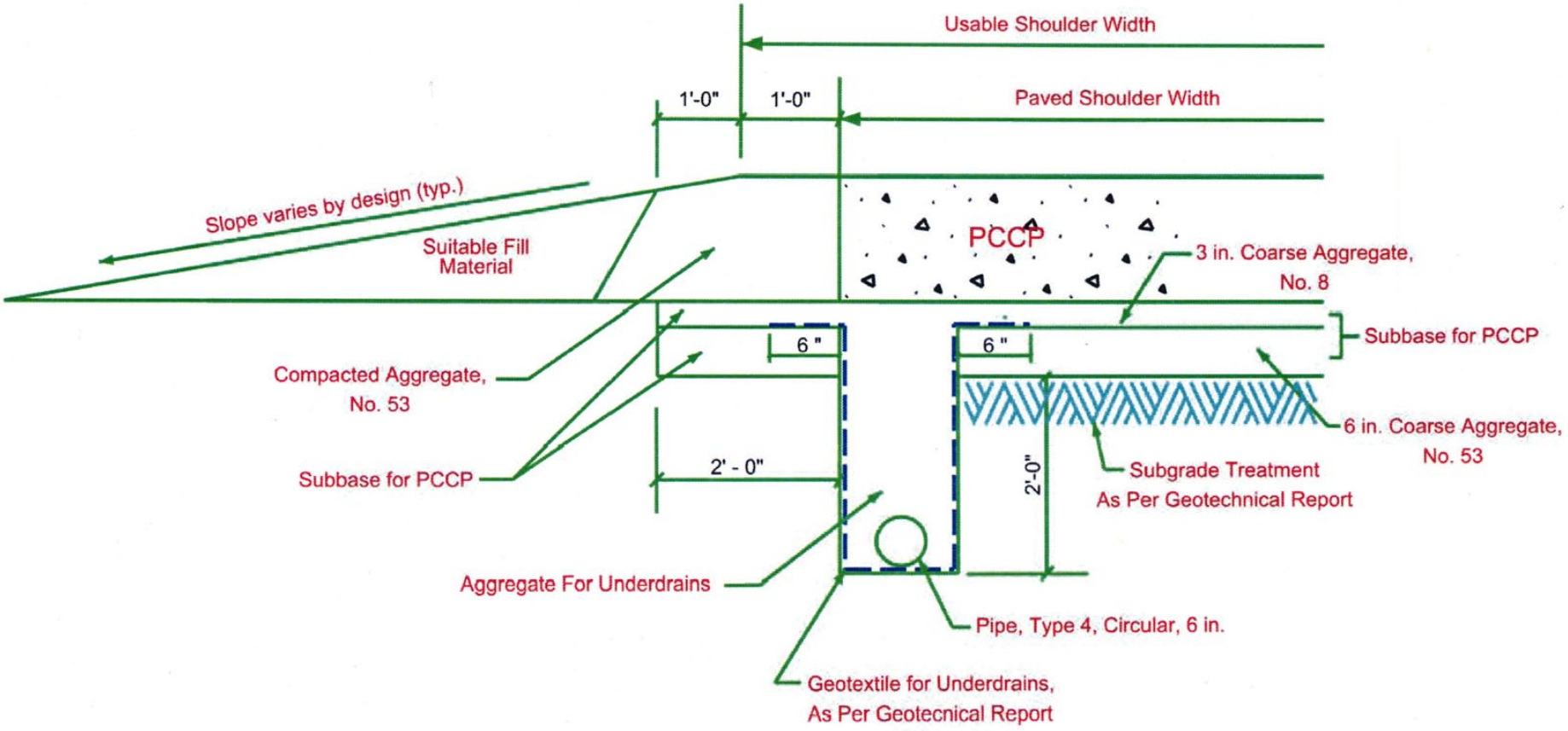
1. PCCP
2. Subbase for PCCP (3 in. Coarse Aggregate #8 On 6 in. Coarse Aggregate, Size No. 53)
   Where underdrains are not required, Dense Graded Subbase should be used.
3. Longitudinal Joint or Longitudinal Construction Joint
4. Subgrade Treatment, Type _____
5. Pipe, Type 4, Circular, 6 in.
6. See Figure 52-13Q for Geotextile Installation Requirements for Curbs (Required Only With Underdrains)
7. 9" Compacted Aggregate, Size No. 53

PCCP WITH CONCRETE CURB

Figure 52-13H

REVISION TO STANDARDS SPECIFICATION

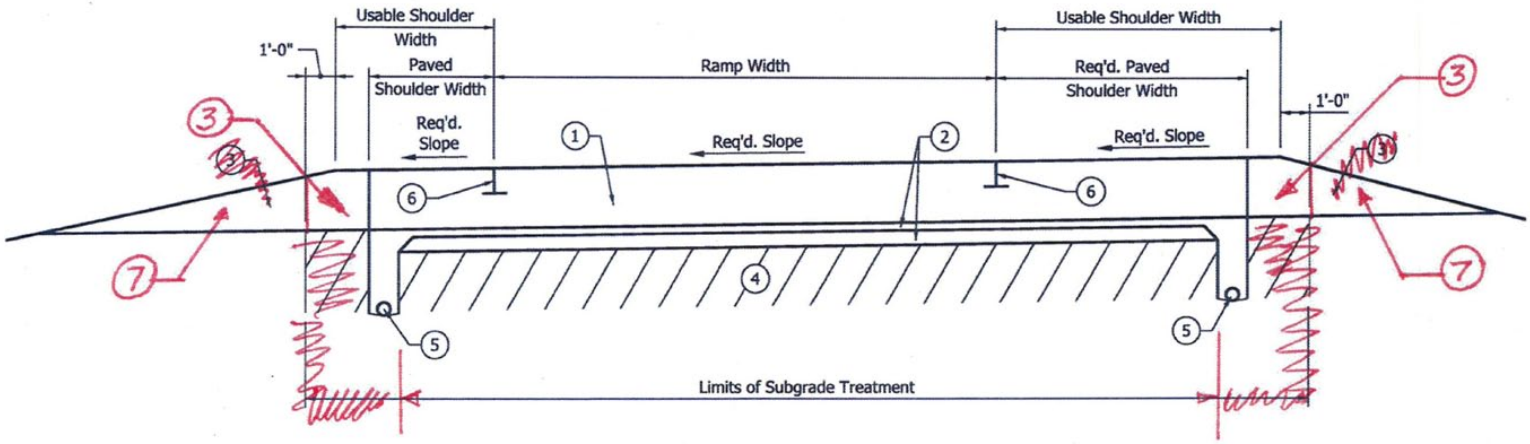
PROPOSED REVISION TO IDM FIGURE 52-13P PCCP WITH UNDERDRAIN



PCCP WITH UNDERDRAIN
Figure 52-13P

REVISION TO STANDARDS SPECIFICATION

PROPOSED REVISION TO IDM FIGURE 52-13T PCCP RAMP



Ramp

1. PCCP
2. Subbase for PCCP (3 in. Coarse Aggregate, Size No. 8 on 6 in. Coarse Aggregate, Size No. 53)
3. Variable Depth Compacted Aggregate, Size No. 53
4. Subgrade Treatment, Type _____
5. Pipe, Type 4, Circular, 6 in.
6. Longitudinal Joint or Longitudinal Construction Joint. See Figure 52-13R for Pavement Joint Options.
7. Suitable Fill Material

PCCP RAMP

Figure 52-13T

REVISION TO STANDARDS SPECIFICATION

BACKUP NO.1 PCCP COST SAVING MEETING MINUTES

PCCP Cost Saving

The PCCP cost saving meeting was held on July 17, 2009 at 1:00 pm. The following people were present on meeting.

Mark Miller	INDOT
Dave Andrewski	INDOT
John Wright	INDOT
Athar A. Khan	INDOT
Tony Zander	INDOT
Tom Carrow	INDOT
Jeff James	INDOT
Mike Byers	ACPA
Ron Zink	E & B Paving
Brian Alfredson	Berns Construction
Paul Tate	Rieth-Riley
Joel Field	Gohmann Asphalt & Construction
Pankaj Patel	INDOT

The following agenda was discussed on meeting.

1) The Contractors wants to reconsider the revised figures 52-13F and 52-13P of IDM chapter 52 approved by Standard Committee on May 21, 2009 meeting.
2) The revised drawing of "PCCP section with HMA shoulder" (Proposed revised figure 52-13G of IDM Chapter 52) based on comments of May12, 2009 meeting.

The comments of the meeting are as follow:

1) The Contractor's concern is no subgrade treatment beyond the outside edge of underdrain will risk the underdrain trench integrity and pavement smoothness due to lack of support of pavers track load. They also commented that constructability of 3 inches of coarse aggregate no.8 outside the underdrain.
2) Dave commented that INDOT pavements are very smooth so we need to revise the spec. in future to lower the initial construction cost.
3) Ron commented that give the Contractor option for longitudinal joint at inside edge of pavement for proposed revised figure 52-13G. As per his remark this will not add any cost to State whether it is joints or not.
4) Both drawings, PCCP section with HMA shoulder and PCCP section with PCCP shoulder, remove the subgrade treatment beyond the outside edge of underdrains.

REVISION TO STANDARDS SPECIFICATION

BACKUP NO.1 PCCP COST SAVING MEETING MINUTES (CONTINUED)

Conclusion:

1) The approved revised Figure 52-13F and Figure 52-13P shows that 3" coarse aggregate No. 8 is 3 inches beyond the outside edge of the underdrains. Extend this layer to 2 feet beyond the outside edge of underdrains. Revised these figures and shows 2 feet of subbase PCCP on prepared subgrade, remove the subgrade treatment Type IIIA treatment.

2) Revised the drawing "PCCP with HMA Shoulder" as follow:
    a) Add the longitudinal joint option at inside edge of pavement.
    b) Remove require slope on inside shoulder.
    c) Remove the subgrade treatment type IIIA beyond the outside edge of underrains
    d) Show subbase for PCCP 2 feet beyond the outside edge of underdrain on both inside and outside shoulder.

Based on the conclusion, Pankaj will redraw the figures and recalculate the cost. Pankaj will send corrected drawings and revised cost saving to everybody thru e-mail. Any comments there after will send directly to Pankaj, no more meeting is require for these figure.

REVISION TO STANDARDS SPECIFICATION

BACKUP NO.2 COST OF HMA SHOULDER VS PCCP SHOULDER

COST OF HMA SHOULDER vs PCCP SHOULDER

(Mainline 12 inches PCCP Section)

4 Lanes divided highways, 4 miles long road,
4 ft inside shoulder and 10 ft outside shoulder

1) Subgrade Treatment
Assume "Type IA" (Remove)

$$\text{Outside shoulder} = \frac{8 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile}}{9} = 18{,}773 \times 2 = 37{,}546 \text{ yd}^2$$

Cost = 37,546 x $6.11/yd^2 = $229,406.00

2) Subbase for PCCP (Remove)

$$\text{Outside Shoulder} = \frac{8 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile} \times 9 \text{ inch} \times 1/12 \text{ ft/inch}}{27}$$

$$= 4{,}693.33 \times 2 = 9{,}386.66 \text{ yd}^3$$

Cost = 9,386.66 x $35.59/yd^3 = $334,071.00

3) 12 inches PCCP (Remove)

$$\text{Outside Shoulder} = \frac{8 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile}}{9} = 18{,}773.33 \times 2 = 37{,}546.66 \text{ yd}^2$$

Cost = 37,546.66 x $40.35/yd^2 = $1,515,008.00

4) D-1 Contraction Joint (Remove on Shoulder)

$$\text{Outside Shoulder} = \frac{4 \text{ miles} \times 5280 \text{ ft/mile}}{16 \text{ ft}} = 1{,}320 \times 8 \text{ ft} \times 2 = 21{,}120 \text{ ft}$$

Cost = 21,120 x $9.91/ft = $209,299.00

5) HMA (Replace PCCP Shoulder)

a) Surface, QC/QA, Catg. 1, PG 64, 9.5mm

Outside Shoulder = $\frac{8 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile}}{9}$

= 18,773.33 yd^2 x 165 lb/yd^2 x 1/2000 t/lb = 1,548.8 x 2 = 3,097.6 TON

Cost = 3,097.6 x $57.68/ton = $178,669.00

b) Base, QC/QA, Catg. 1, PG 64, 25.0mm

Outside Shoulder = $\frac{8 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile}}{9}$

= 18,773.33 yd^2 x 495 lb/yd^2 x 1/2000 t/lb = 4,646.4 x 2 = 9,292.8 TON

Cost = 9,292.8 x $60.49/ton = $562,121.00

c) Compacted Aggregate, No. 53, Base

Outside Shoulder = 8 ft x 4 miles x 5280 ft/mile x 6 inch x 1/12 ft/inch

= 84,480 x 2 = 160,960 ft^3

= 160,960 ft^3 x 125 lb/ ft^3 (density) x 1/2000 TON/lb = 10,560 TON

Cost = 10,560 x $18.56/TON = $195,994.00

Total HMA Cost = ($178,669.00 + $562,121.00 + $195,994.00)

= $936,784.00

Total Saving = $229,406.00 + $334,071.00 + $1,515,008.00 + $209,299.00 -$936,784.00

= $1,351,000.00 ($337,750.00/mile – 4 lanes)

COST SAVING OF MODIFIES Figure 52-13F and Figure 52-13P OUTSIDE UNDERDRAIN

(PCCP SECTION WITH PCC SHOULER)

4 Lanes divided highways, 4 miles long road

(Outside and Inside Shoulders)

2) Subgrade Treatment

Assume "Type IA" (Remove)

$$\frac{2 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile}}{9}$$

4,694 x 4 = 18,776 yd^2

Cost = 18,776 x \$6.35/yd^2 = \$119,228.00

2) Subbase for PCCP (Install)

$$\frac{2 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/mile} \times 9 \text{ inch} \times 1/12 \text{ ft/inch}}{27}$$

1,173.33 x 4 = 4,693.33 yd^3

Cost = 4,693.33 x \$36.58/yd^3 = \$171,682.00

6) Compacted Aggregate, No. 53 (Remove 9")

2.0 ft x 4 miles x 5280 ft/mile x 9 inch x 1/12 ft/inch

31,680 x 4 = 126,720 ft^3

126,720 ft^3 x 125 lb/ ft^3 (density) x 1/2000 TON/lb = 7,920

Cost = 7,920 x \$19.71/TON = \$156,103.00

7) Compacted Aggregate, No. 53 (Assume 6:1 slope) Remove

½ x 1.163 ft x 7 ft x 4 miles x 5280 ft/ml

85,969 ft^3 x 4 = 343,876 ft^3

343,876 ft^3 x 125 lb/ ft^3 (density) x 1/2000 TON/lb = 21,492 TON

Cost = 21,492 x $19.71/TON = $423,607.00

8) Borrow (Remove # 53 outside shoulder break point and replace with Borrow)

$$\frac{\frac{1}{2} \times 1.163 \text{ ft} \times 7 \text{ ft} \times 4 \text{ miles} \times 5280 \text{ ft/ml}}{27}$$

3,184 x 4 = 12,736 yd^3

Cost = 12,736 x $18.04/ yd^3 = $229,757.00

9) Seeding, Mulch, and Fertilizer on Slope

Surface Area = 7.09 ft x 4 mile x 5280 ft/mile
= 149,741 ft^2 x 4
= 598,964 ft^2 x 1/43,560 acre/ft^2
= 13.75 acre

a) Seed Mixture, R = 13.75 acre x 170 lb/acre
= 2338 lb x $4.66/lb = $10,895.00
b) Mulching Material = 13.75 acre x 2 T/acre
= 27.5 T x $550/T = $15,125.00
c) Fertilizer = 13.75 acre x 0.4 T/acre
= 5.5 T x $789/T = $4,340.00

Total for Grass = $10,895.00 + $15,125.00 + $4,340.00 = $30,360.00

Total Saving = $119,228.00 - $171,682.00 + $ 156,103.00
+ $423,607.00 - $229,757.00 - $30,360.00

= $267,139.00 ($66,785.00/mile – 4 lanes)

COMMENTS AND ACTION

REVISION TO IDM FIGURE 52-13F PCCP SECTION WITH PCC SHOULDER
REVISION TO IDM FIGURE 52-13G PCCP SECTION WITH HMA SHOULDER
REVISION TO IDM FIGURE 52-13H PCCP WITH CONCRETE CURB
REVISION TO IDM FIGURE 52-13P PCCP WITH UNDERDRAIN
REVISION TO IDM FIGURE 52-13T PCCP RAMP

Motion: Second: Ayes: Nays: Standard Specifications Sections affected: Section 500 Recurring Special Provision affected: None Standard Sheets affected: None Design Manual Section affected: Section 52 GIFE Sections affected: Sections 6, 7 and 8	Action: _____ Passed as Submitted _____ Passed as Revised __X__ 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. Andrewski
Date: 01/21/10

SPECIFICATION REVISIONS

REVISION TO STANDARDS SPECIFICATION AND STANDARD DRAWINGS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The Mechanistic Empirical Pavement Design Guide's adoption by INDOT has decreased pavement thicknesses and designs for joint spacing in PCCP. The Standard Specifications and Standard Drawing E 503-CCPJ-01 need to be revised to reflect these changes.

PROPOSED SOLUTION: Delete reference to joint spacing in the Standard Specifications and revise Standard Drawing E 503-CCPJ-01 Dowel Bar Size Table for pavement thickness and add column specifying maximum joint spacin for differing pavement thicknesses.

APPLICABLE STANDARD SPECIFICATIONS: 503.03 (a) Type D-1 Contraction Joint

APPLICABLE STANDARD DRAWINGS: E 503-CCPJ-01

APPLICABLE DESIGN MANUAL SECTION: Chapter 52

APPLICABLE SECTION OF GIFE:Section 8.7.2

APPLICABLE RECURRING SPECIAL PROVISIONS:NA

Submitted By: David Andrewski

Title: Manager, Office of Pavement Engineering

Organization: INDOT

Phone Number: 317-232-5452

Date: December 17, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT?Pavement Steering Committee

REVISION TO STANDARDS SPECIFICATION AND STANDARD DRAWINGS

REVISION TO SECTION 503.03(a) TYPE D-1 CONTRACTION JOINT

The Standard Specifications are revised as follows:

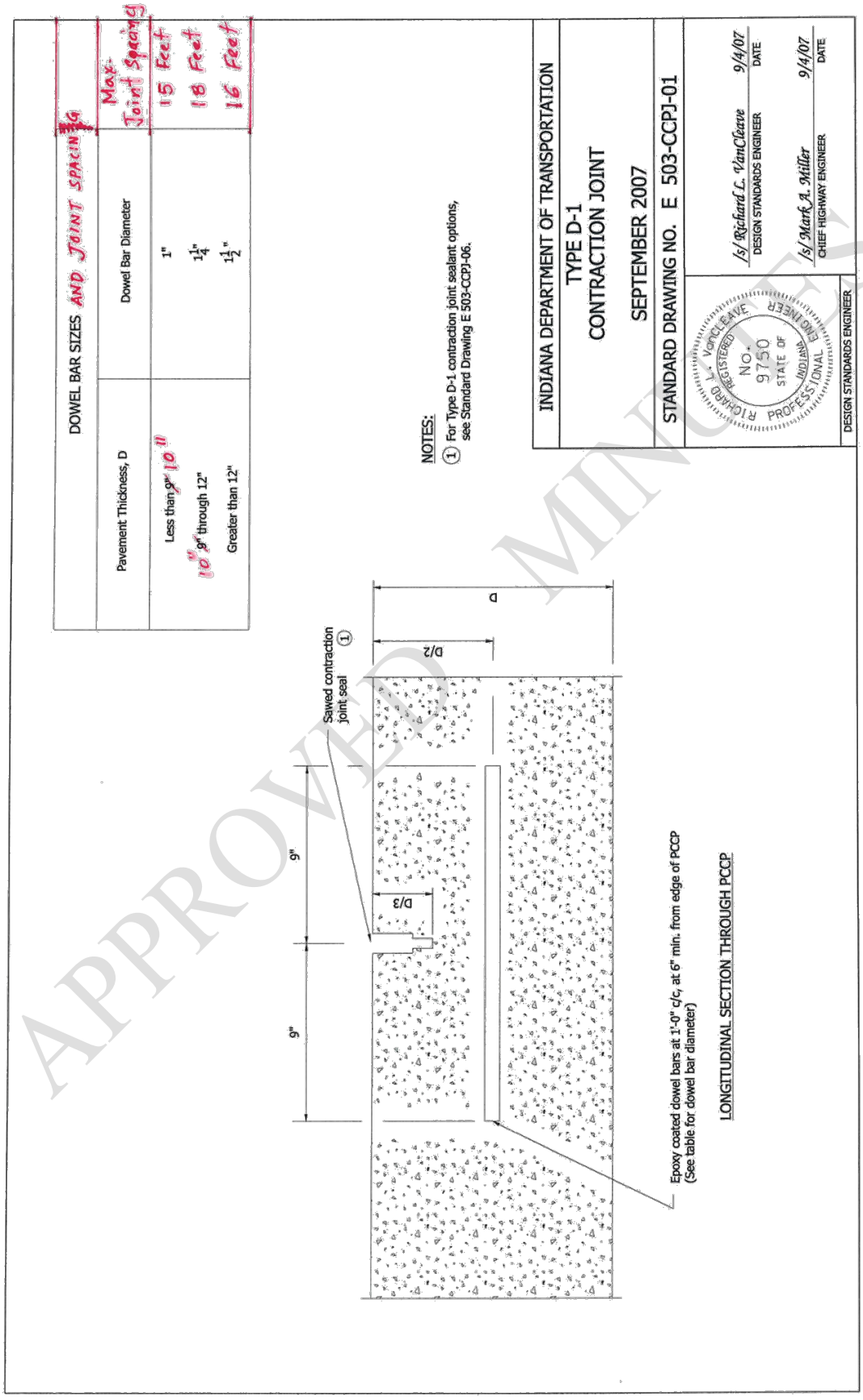
SECTION 503, BEGIN LINE 44, DELETE AS FOLLOWS:

(a) Type D-1 Contraction Joint

Type D-1 contraction joints shall be created by sawing slots in the pavement unless alternative methods are approved. The sawed contraction joint spacing shall be as shown on the plans or as directed~~, but shall not exceed 18 ft (5.5 m)~~.

REVISION TO STANDARDS SPECIFICATION AND STANDARD DRAWINGS

REVISION TO STANDARD DRAWING E 503-CCPJ-01 TYPE D-1 CONTRACTION JOINT



COMMENTS AND ACTION

REVISION TO SECTION 503.03(a) TYPE D-1 CONTRACTION JOINT
REVISION TO STANDARD DRAWING E 503-CCPJ-01 TYPE D-1 CONTRACTION JOINT

Mr. Andrewski stated that the reason for this revision comes from the fact that as PCCP pavement increases in thickness, the internal stresses in the pavement also increase. This is especially true in the first few days as the pavement cures. To counteract this, the spacing between the joints needs to be reduced.

This item was withdrawn by action of the Standards Committee on March 18, 2010 due to changes in design procedures. The new procedures require an evaluation on a contract by contract basis.

Motion: Mr. Andrewski Second: Mr. Cales Ayes: 9 Nays: 0	Action: ~~ X ~~ Passed as Submitted _____ Passed as Revised X Withdrawn
Standard Specifications Sections references for D-1 Type Contraction Joint: 501.26 p.297; 503.03 p.319 thru p.323; 506.11 p.334; 506.12 p.335; 507.01 p.336; 606.02 p.377; 706.05 p.518, 519; 706.06 p.520	~~ X ~~ 2012 Standard Specifications Book ~~ X ~~ Create RSP (No._____) Effective ~~Sep. 01, 2010~~ Letting RSP Sunset Date: _____ _____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Recurring Special Provision references: 503-R-516 PCCP STITCHING Standard Sheets affected: E 503-CCPJ-01	Standard Drawing Effective ~~Sep. 01, 10~~ ~~ X ~~ Create RPD (No. _____) Effective _____Letting _____ Technical Advisory
Design Manual Sections affected: Chapter 52 GIFE Sections affected: Section 8.7.2; 9.2(g)	GIFE Update Req'd.? Y ___ N ___ By _____ Addition or _____ Revision Frequency Manual Update Req'd? Y___N___ By _____ Addition or _____ Revision Received FHWA Approval? ~~ X ~~

Mr. Wright
Date: 01/21/10

SPECIFICATION REVISIONS

REVISION TO STANDARD DRAWINGS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Design consultants request from INDOT a detail showing the pavment header at the railroad crossing. This includes the pavement type, thickness, dimensions, etc. INDOT does not currently have a standard detail.

PROPOSED SOLUTION: Provide designers a Standard Railroad Header Detail for both HMA and PCCP headers and dependant upon the adjoining pavement types. There are separate details for concrete and HMA designs. These will also include single, as well as multiple tracks. These details can also be used for construction detail and estimating construction costs.

APPLICABLE STANDARD SPECIFICATIONS: 614

APPLICABLE STANDARD DRAWINGS: Railroad Crossing Details Including - (HMA Header, RC Header, HMA Inter-Track, and RC Inter-track, and a Crown-Out Detail)

APPLICABLE DESIGN MANUAL SECTION: 47

APPLICABLE SECTION OF GIFE:N/A

Submitted By: John Wright / Tom Rueschhoff

Title: Roadway Services Manager

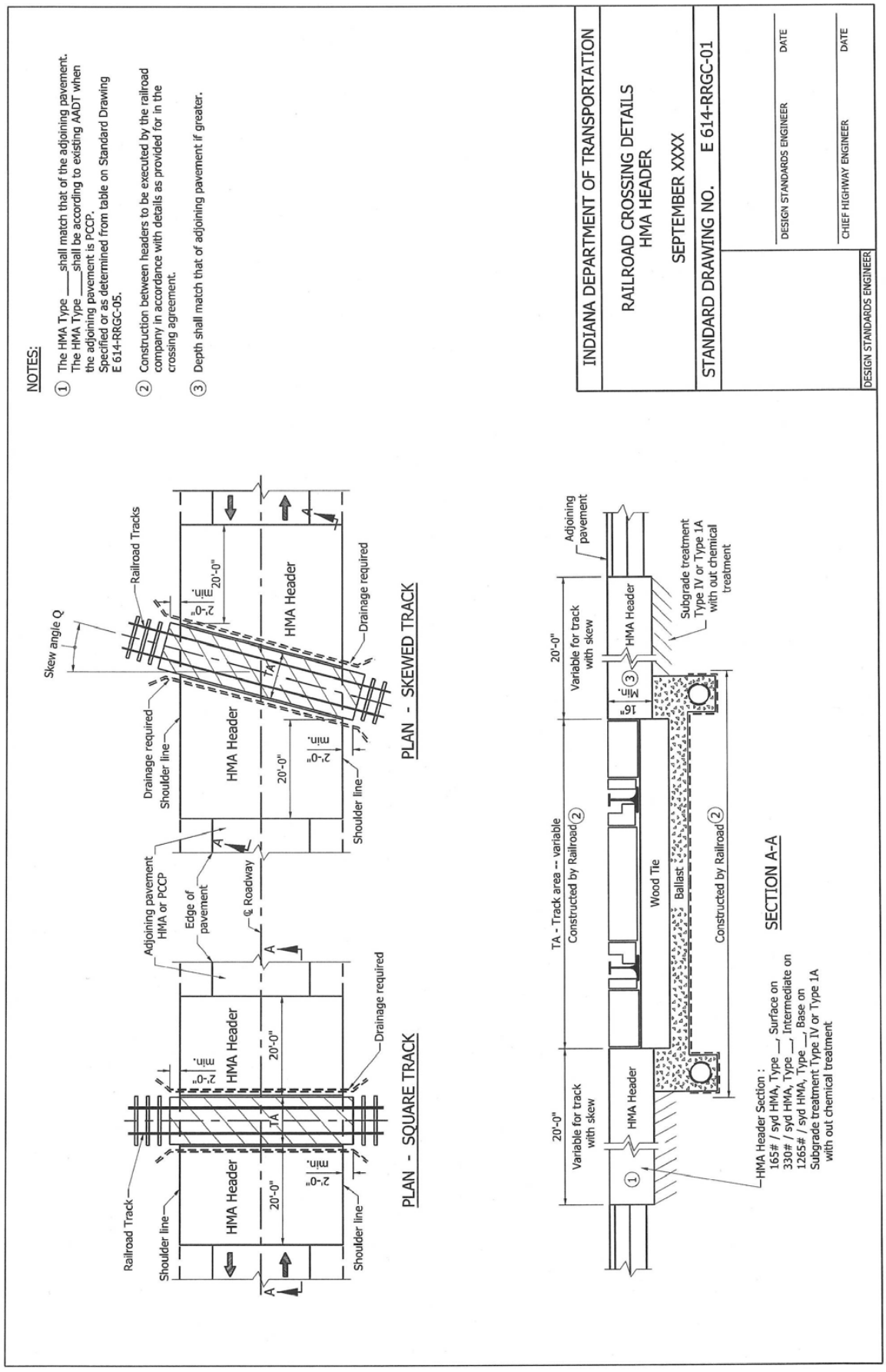
Organization: INDOT

Phone Number: 232-5147

Date: 12/21/09

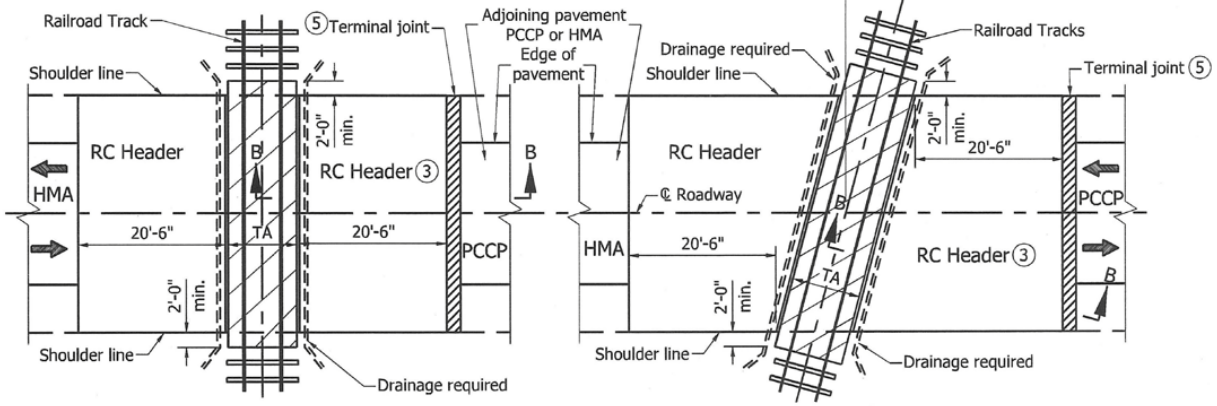
REVISION TO STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E-614-RRGC-01 RAILROAD CROSSING DETAILS HMA HEADER



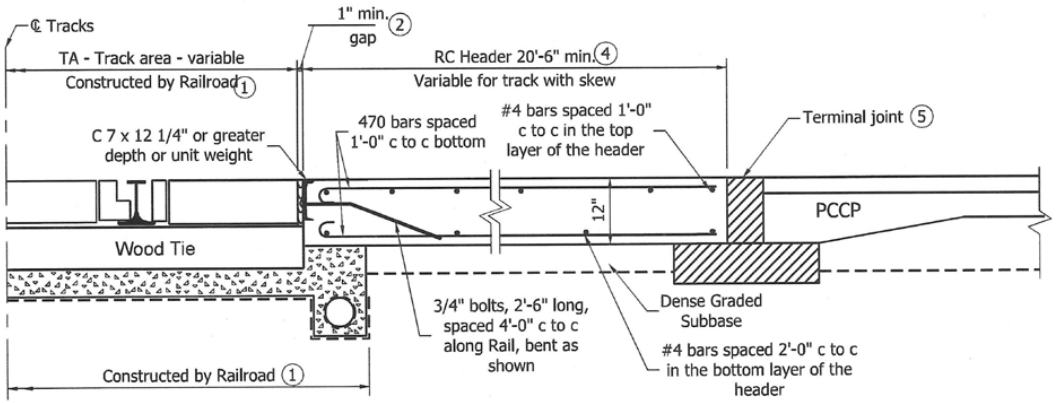
REVISION TO STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E-614-RRGC-02 RAILROAD CROSSING DETAILS RC HEADER



PLAN - SQUARE TRACK

PLAN - SKEWED TRACK



HALF SECTION B - B

W

470 x ((W-6") + 16")

NOTES:

① Construction between headers to be executed by the railroad company in accordance with details as provided for in the crossing agreement.

② 1 in. min. joint filler

③ Terminal joint shall be used where PCC Header abuts PCCP pavement.

④ For reinforcement details see Standard Drawing E 609-RCBA-01 and E 609-RCBA-03 to -06

⑤ For terminal joint details see Standard Drawing E 609-RCBA-02.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILROAD CROSSING DETAILS
RC HEADER

SEPTEMBER XXXX

STANDARD DRAWING NO. E 614-RRGC-02

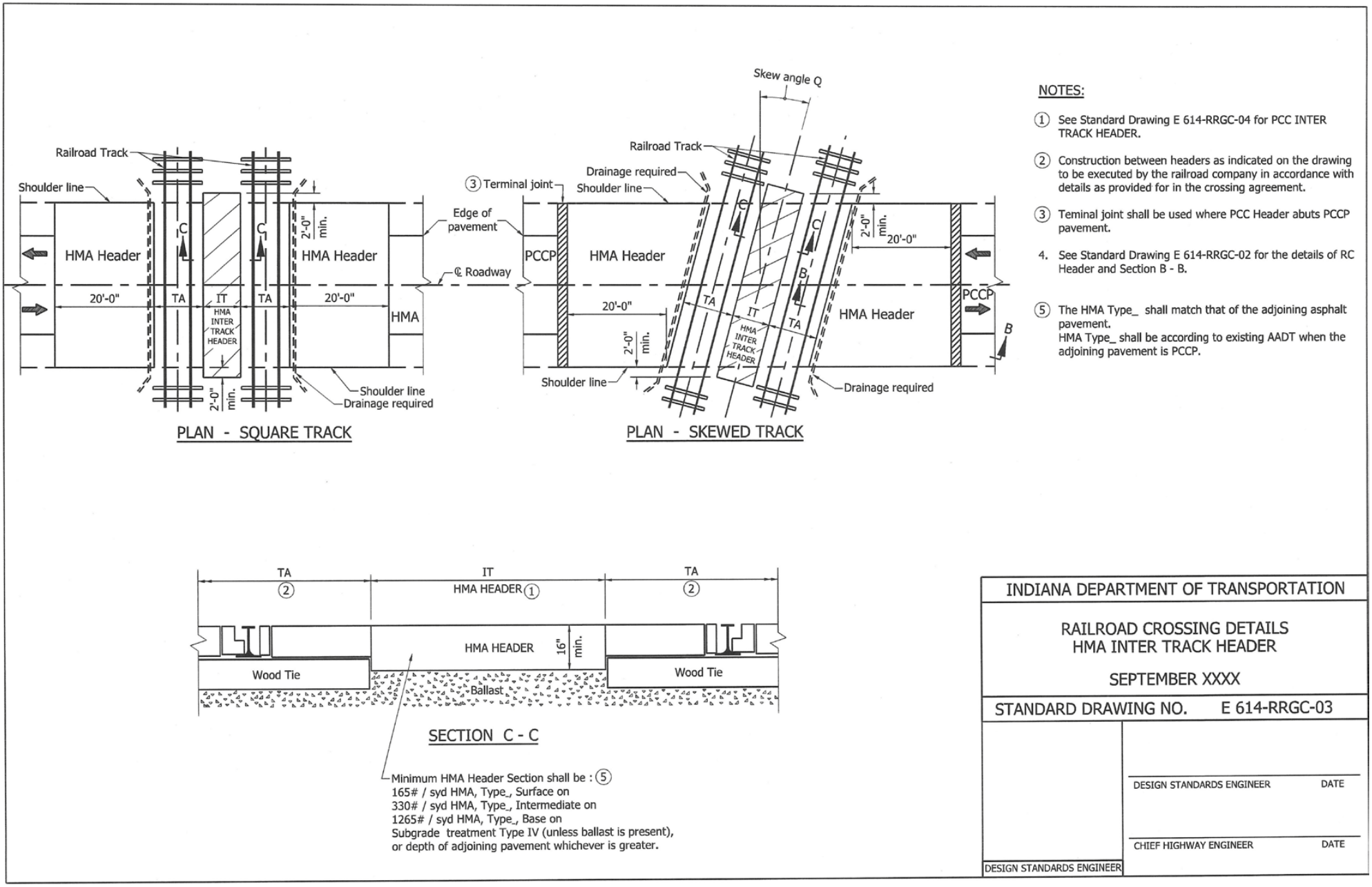
DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

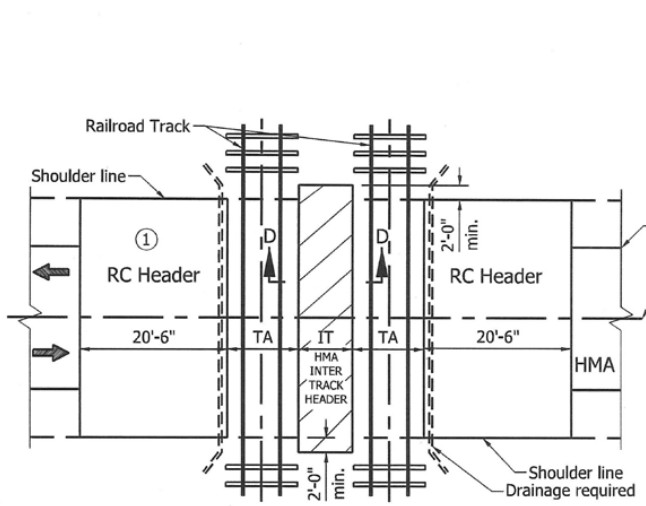
REVISION TO STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E-614-RRGC-03 RAILROAD CROSSING DETAILS HMA INTER TRACK HEADER

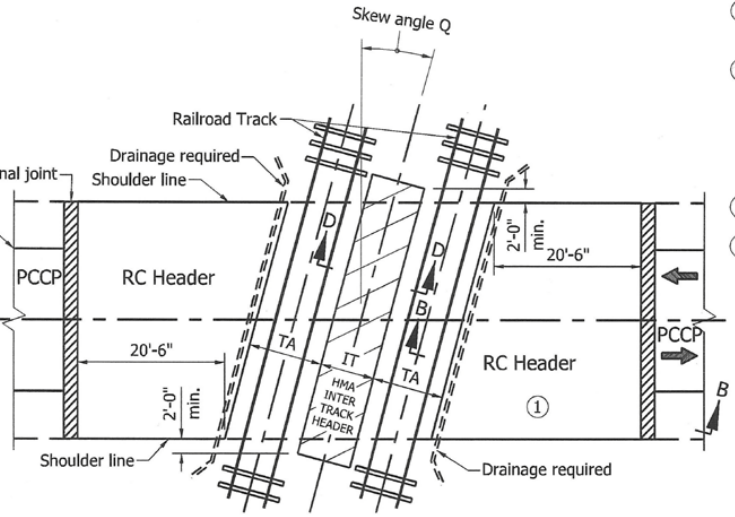


REVISION TO STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E-614-RRGC-04 RAILROAD CROSSING DETAILS RC INTER TRACK HEADER



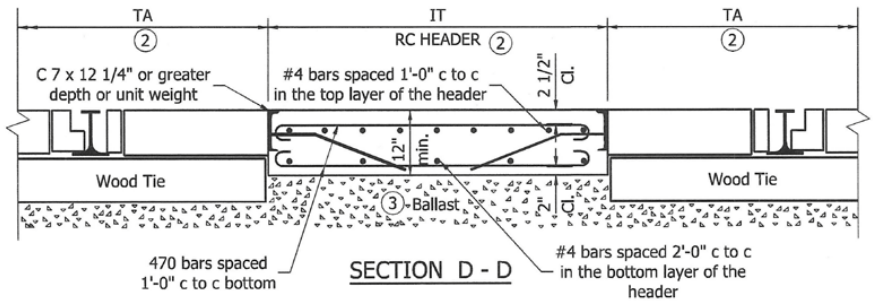
PLAN - SQUARE TRACK



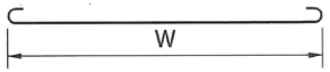
PLAN - SKEWED TRACK

NOTES:

1. See Standard Drawing E 614-RRGC-02 for the details of RC Header and Section B - B.
2. Unless otherwise specified,
   If IT ≥ 15' construct pavement section as shown
   If IT < 15' no work required.
   (Construction between headers as indicated on the drawing to be executed by the railroad company in accordance with details as provided for in the crossing agreement.)
3. Place 6" dense graded subbase unless ballast is present.
4. Teminal joint shall be used where RC Header abuts PCCP pavement.



SECTION D - D



470 x ((W-6") + 16")

INDIANA DEPARTMENT OF TRANSPORTATION

RAILROAD CROSSING DETAILS
RC INTER TRACK HEADER

SEPTEMBER XXXX

STANDARD DRAWING NO. E 614-RRGC-04

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

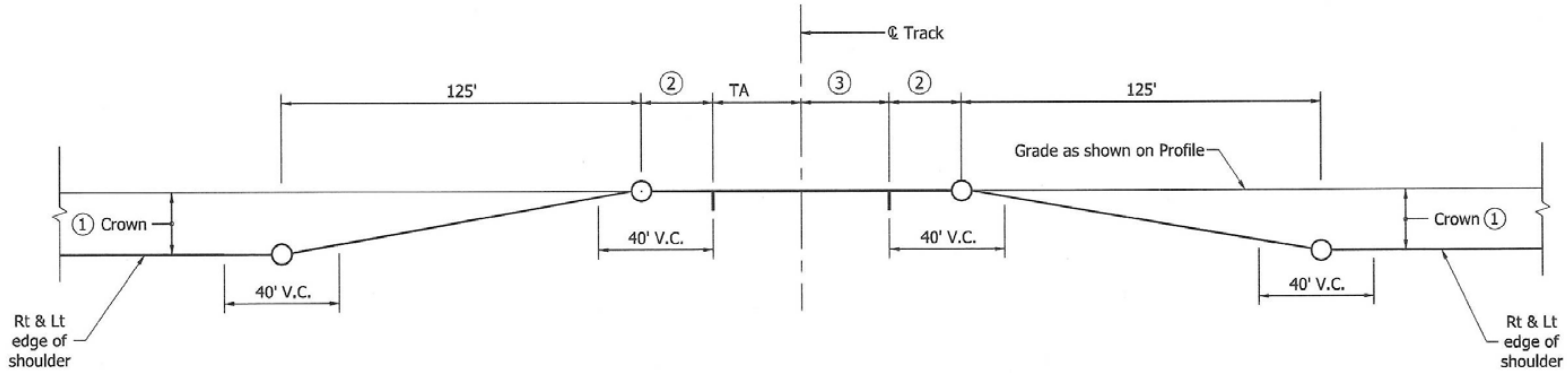
DESIGN STANDARDS ENGINEER

REVISION TO STANDARD DRAWINGS

PROPOSED NEW STANDARD DRAWING E-614-RRGC-05 RAILROAD CROSSING DETAILS CROWN-OUT DIAGRAM

NOTES:

1. Crown shall be taken out of pavement at each railroad crossing.
2. 20 ft or as required due to track skew.
3. TA is a track area to be constructed by railroad company.



Construction-Year AADT	HMA Type
<200	A
200 ≤ AADT <2000	B
2000 ≤ AADT <7000	C
≥ 7000	D

HMA TYPES FOR RAILROAD HEADERS WHEN THE AJOINING PAVEMENT IS PCCP

INDIANA DEPARTMENT OF TRANSPORTATION

RAILROAD CROSSING DETAILS
CROWN-OUT DIAGRAM

SEPTEMBER 200X

STANDARD DRAWING NO. E 614-RRGC-05

DESIGN STANDARDS ENGINEER DATE

CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

COMMENTS AND ACTION

NEW STANDARD DRAWING E-614-RRGC-01 RAILROAD CROSSING DETAILS
NEW STANDARD DRAWING E-614-RRGC-02 RAILROAD CROSSING DETAILS
NEW STANDARD DRAWING E-614-RRGC-03 RAILROAD CROSSING DETAILS
NEW STANDARD DRAWING E-614-RRGC-04 RAILROAD CROSSING DETAILS
NEW STANDARD DRAWING E-614-RRGC-05 RAILROAD CROSSING DETAILS
(DETAILS WITH VARIOUS HEADERS AND CROWN-OUT DIAGRAM)

Motion: Second: Ayes: Nays:	Action: _____ Passed as Submitted _____ Passed as Revised __X__ Withdrawn
Standard Specifications Sections affected: Section 614 – CONCRETE HEADER	_____ 20__ Standard Specifications Book
Recurring Special Provision affected: None	_____ Create RSP (No._____) Effective _____Letting RSP Sunset Date: _____ _____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Standard Sheets affected: None	Standard Drawing Effective _____
Design Manual Sections affected: Section 47	_____ Create RPD (No. _____) Effective _____Letting _____ Technical Advisory
GIFE Sections affected: None	GIFE Update Req'd.? Y ___ N ___ By _____ Addition or _____ Revision Frequency Manual Update Req'd? Y___N___ By _____ Addition or _____ Revision
	Received FHWA Approval? _____