INDIANA DEPARTMENT OF TRANSPORTATION

STANDARDS COMMITTEE MEETING

Driving Indiana's Economic Growth

APPROVED MINUTES

October 15, 2009 Standards Committee Meeting

(Approved as Revised at November 19, 2009 Standards Committee Meeting. Changes shown as highlighted in Yellow)

APPROVED MINUTES

MEMORANDUM

November 20, 2009

TO: Standards Committee

FROM: Jim Reilman, Acting Secretary

RE: Minutes for the October 15, 2009 Standards Committee Meeting

The Standards Committee meeting was called to order by the Chairman at 9:08 a.m. on October 15, 2009 in the N755 Bay Window Conference Room. The meeting was adjourned at 12:48 p.m.

The following committee members were in attendance:

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

Also in attendance were the following:

Jim Reilman, Acting Secretary
Tony Uremovich, Structural. Services
Bren George, FHWA
Steve Fisher, INDOT
Joe Novak, INDOT
Paul Berebitsky, ICA
Dana Plattner, INDOT
Ting Nahrwold, INDOT
Tom Sheets, SWARCO IND.

Also in attendance were the following (continued):

Christa Petzke, CONTECH Construction Products Inc
Bill Waller, CONTECH Construction Products Inc
Kurt Schleter, Gridlock Traffic Systems, Inc
Steve Apple, Indiana Sign & Barricade, Inc
Eric Carleton, Independent Concrete Pipe Co.
Rick P. Smith, RoadSafe Traffic Systems
Steve Smart HySpanBridges/Ind.Con. Pipe
Doug Nagel, RoadSafe Traffic Systems

The following items were considered:

Page No.

A. GENERAL BUSINESS ITEMS

OLD BUSINESS

(No items considered)

NEW BUSINESS

1. Approval of the September 17, 2009 Minutes

ACTION: Approved as Submitted

Motion: Mr. Andrewski
Second: Mr. Cales
Ayes: 10
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

Item No. 03 04/16/09 (2010 SS)	Ms. Rearick	4
Standard Drawings:		
714-CCSP-01 through -06	THREE SIDED CONCRETE CULVERT SCOUR PROTECTION	
715-PCSP-01	*PIPE CULVERT SUMPING PROTECTION*	
723.17	Scour Protection	
723.18	Method of Measurement	
723.19	Basis of Payment	
IDM 31-3.04(07)	*Culvert Sumping*	

ACTION: Passed as Revised

APPROVED MINUTES

NEW BUSINESS

Item No. 01 10/15/09 (2010 SS)	Mr. Shields	21
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 OF RETROREFLECTIVE PAVEMENT MARKING MATERIALS	
ACTION:	Withdrawn	

Item No. 02 10/15/09 (2010 SS)	Ms. Rearick	78
Standard Drawing:		
701-BPIL-04	SPLICING PIPE PILES IN FIELD	
ACTION:	Withdrawn	

APPROVED MINUTES

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

SPECIFICATION REVISIONS

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: IDEM, as a part of the Section 401 permitting process, is now requiring culverts to be sumped in order to allow for uninterrupted movement of stream-bed material through the culverts.

PROPOSED SOLUTION: Revise the Standard Drawings for three-sided-culvert scour protection to allow for passage of natural stream-bed material as required by IDEM. Standard Drawings 714-CCSP-01 through -05 are affected, with a new drawing added. The CCSP series will be renumbered as follows:

New	Old	Drawing Subject
01	01	3-Sided, Riprap Method, Span at least 10' but less than 20', plan view
02	03	3-Sided, Riprap Method, Span at least 10' but less than 20', section view
03	01	3-Sided, Riprap Method, Span greater than 20', plan view
04	02	3-Sided, Riprap Method, Span greater than 20', section view
05	04	3-Sided, Base-Slab Method, plan view
06	05	3-Sided, Base-Slab Method, section view

New drawing 715-PCSP-01 is added to show the sump treatment for a pipe culvert.

The proposed revisions will result in less excavation and a reduction in the amount of riprap required. The reduction in excavation and riprap will have a side benefit of a cost reduction for INDOT.

Riprap required for culvert sumping will not be measured for its own pay item. This will require revisions to Standard Specifications Sections 723.17, 723.18, and 723.19.

We prefer, upon passage, that this concept be effective for the first practical letting short of contract revisions. That will require a recurring special provision and recurring plan details. The drawings included herein are therefore in the RPD format. All changes proposed to the standard drawings and comments from previous Standards Committee meetings and other discussions have been electronically incorporated into the RPDs.

APPLICABLE STANDARD SPECIFICATIONS: 723.17, 723,18, and 723.19

APPLICABLE STANDARD DRAWINGS: 714-CCSP-01 through -06, 715-PCSP-01, as recurring plan details, until standard drawings are issued

APPROVED MINUTES

SPECIFICATION REVISIONS

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

APPLICABLE DESIGN MANUAL SECTION: New section, 31-3.04(07) Culvert Sumping

APPLICABLE SECTION OF GIFE: None

Submitted By: Anne Rearick

Title: Manager, Office of Structural Services

Organization: INDOT

Phone Number: 232-5152

Date: 8-03-09

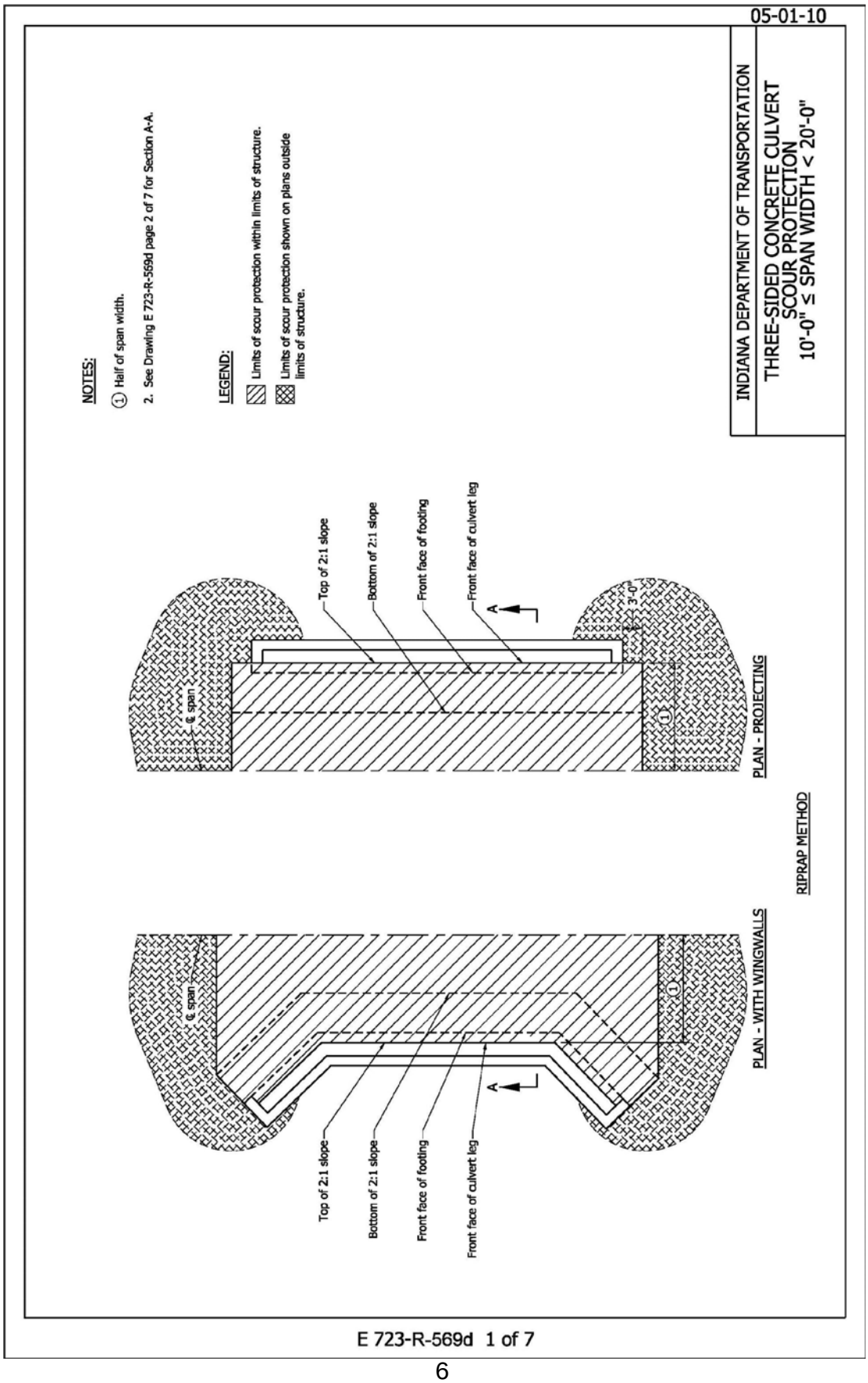
APPROVED MINUTES

Item No. 03 04/16/09 (2010 SS)
Ms. Rearick
Date: 10/15/09

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

714-CCSP-01 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION

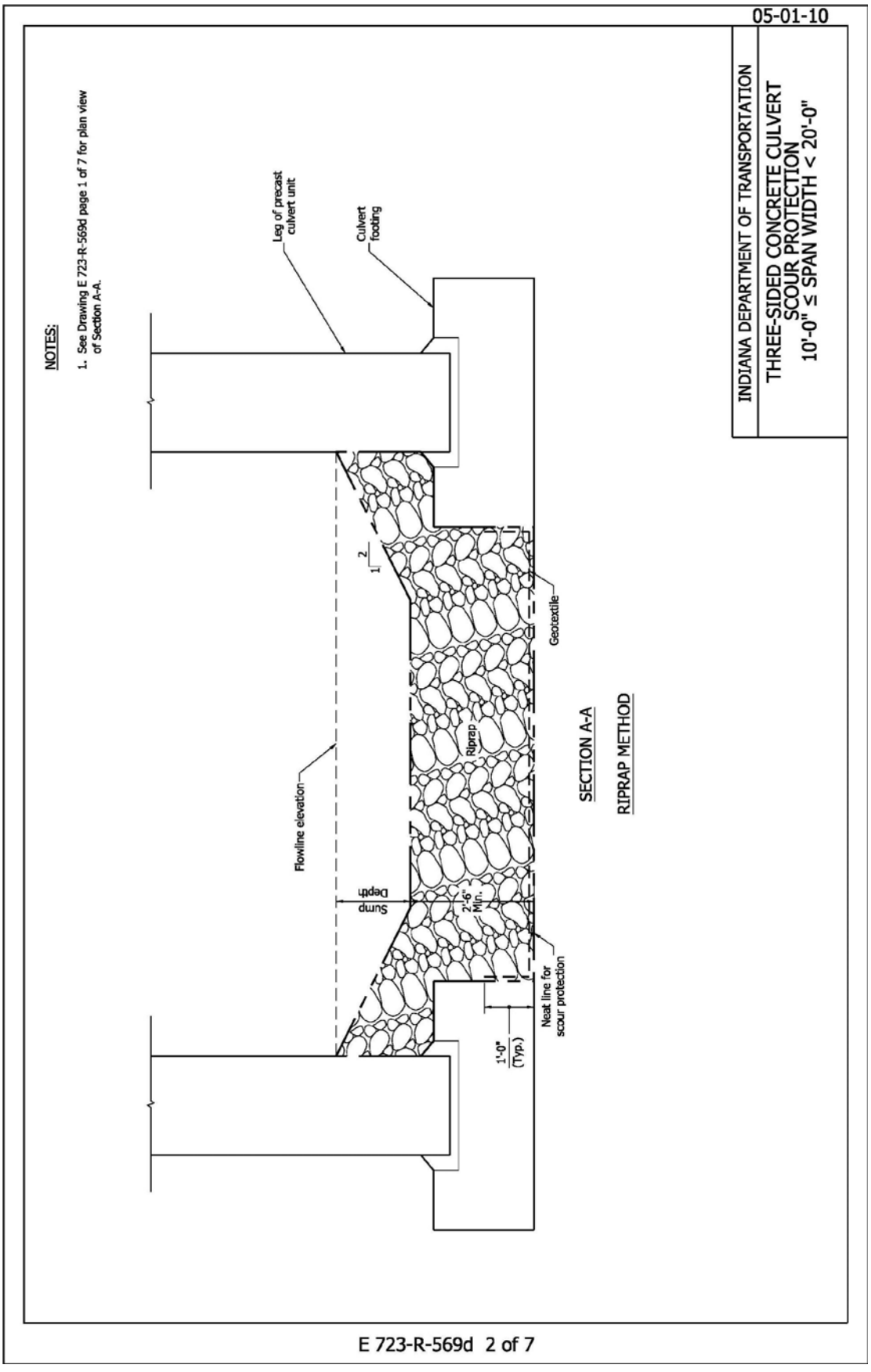
(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARD COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

714-CCSP-02 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION

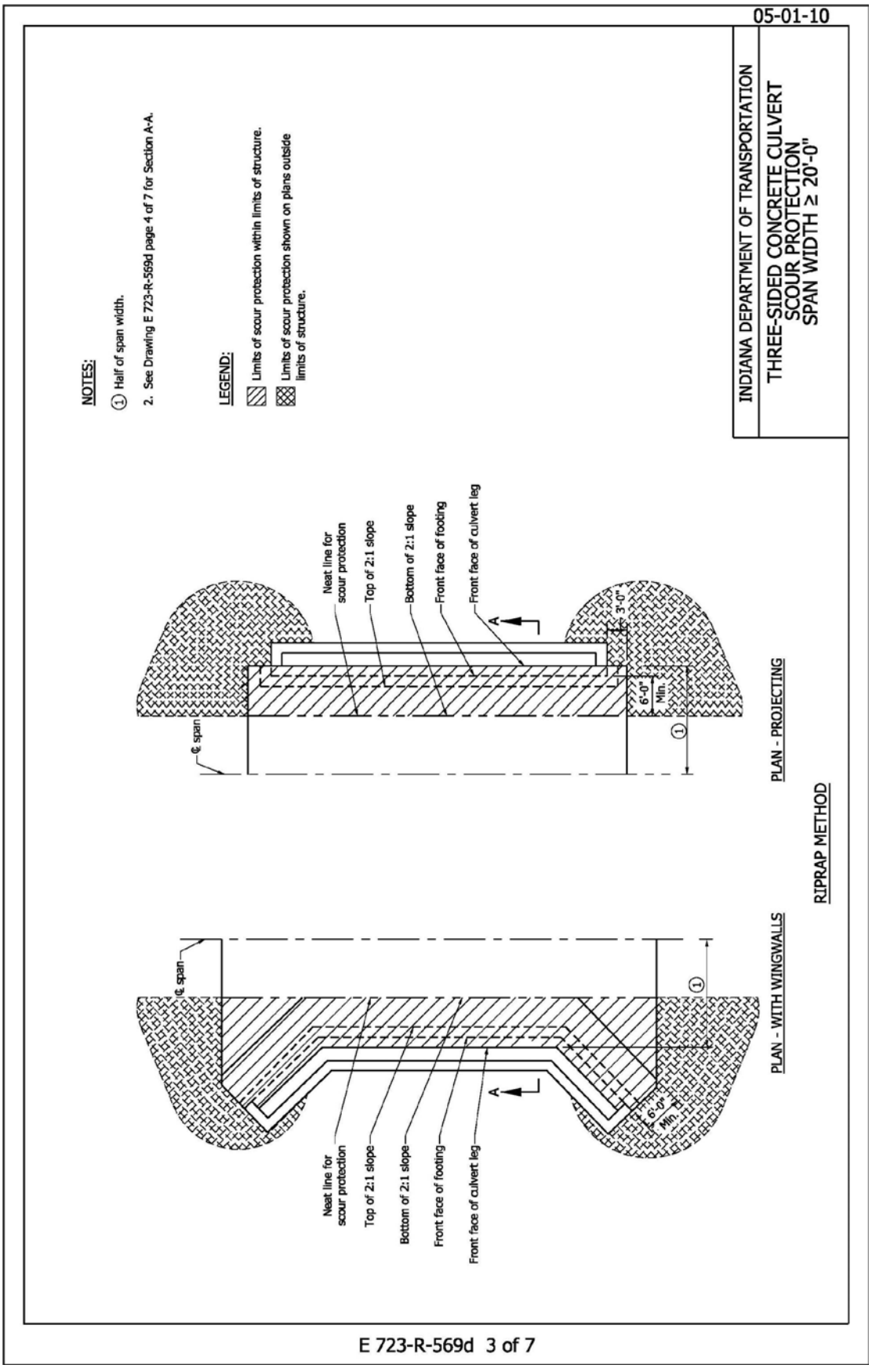
(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARDS COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

714-CCSP-03 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION

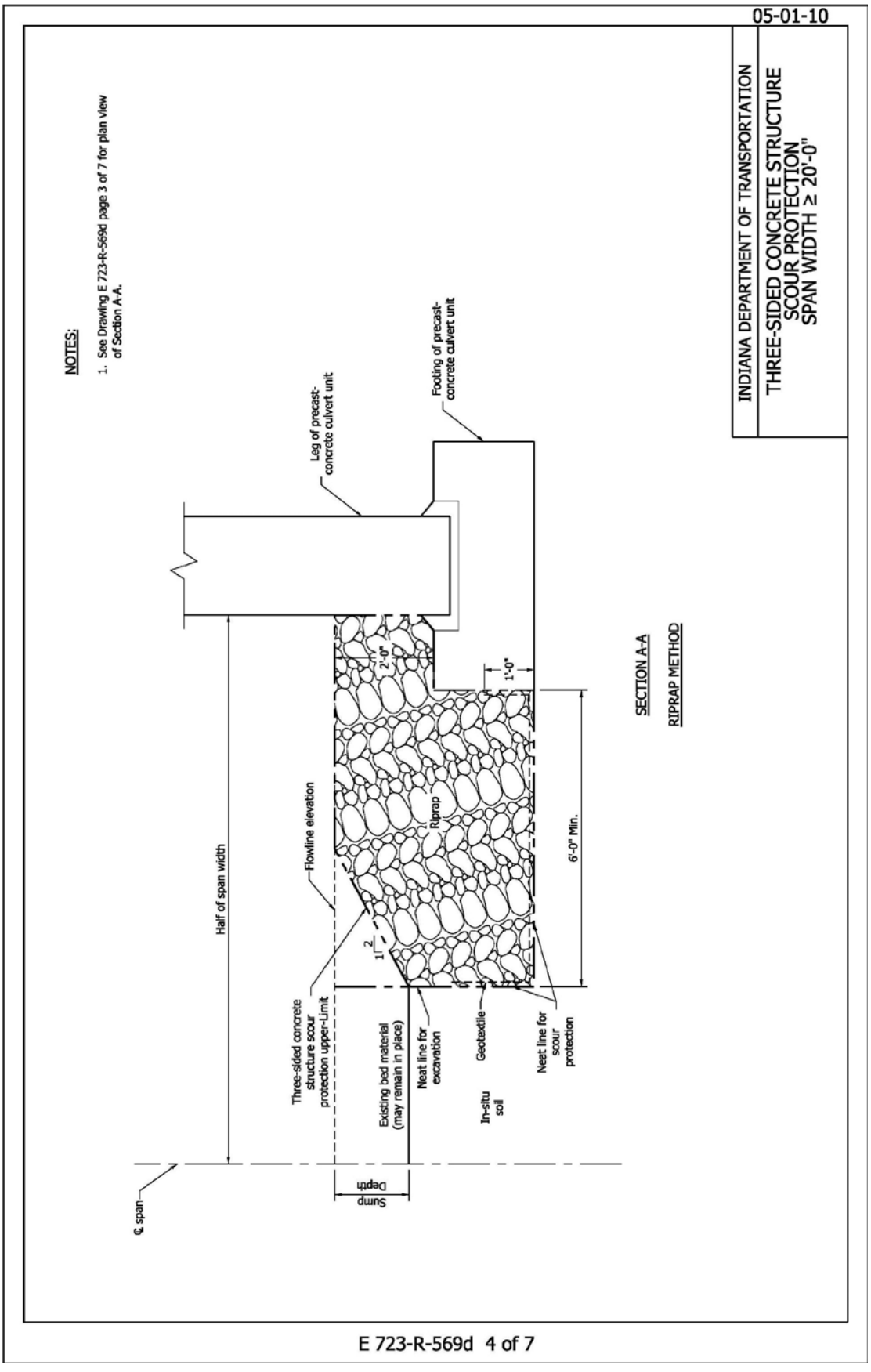
(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARD COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

714-CCSP-04 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION

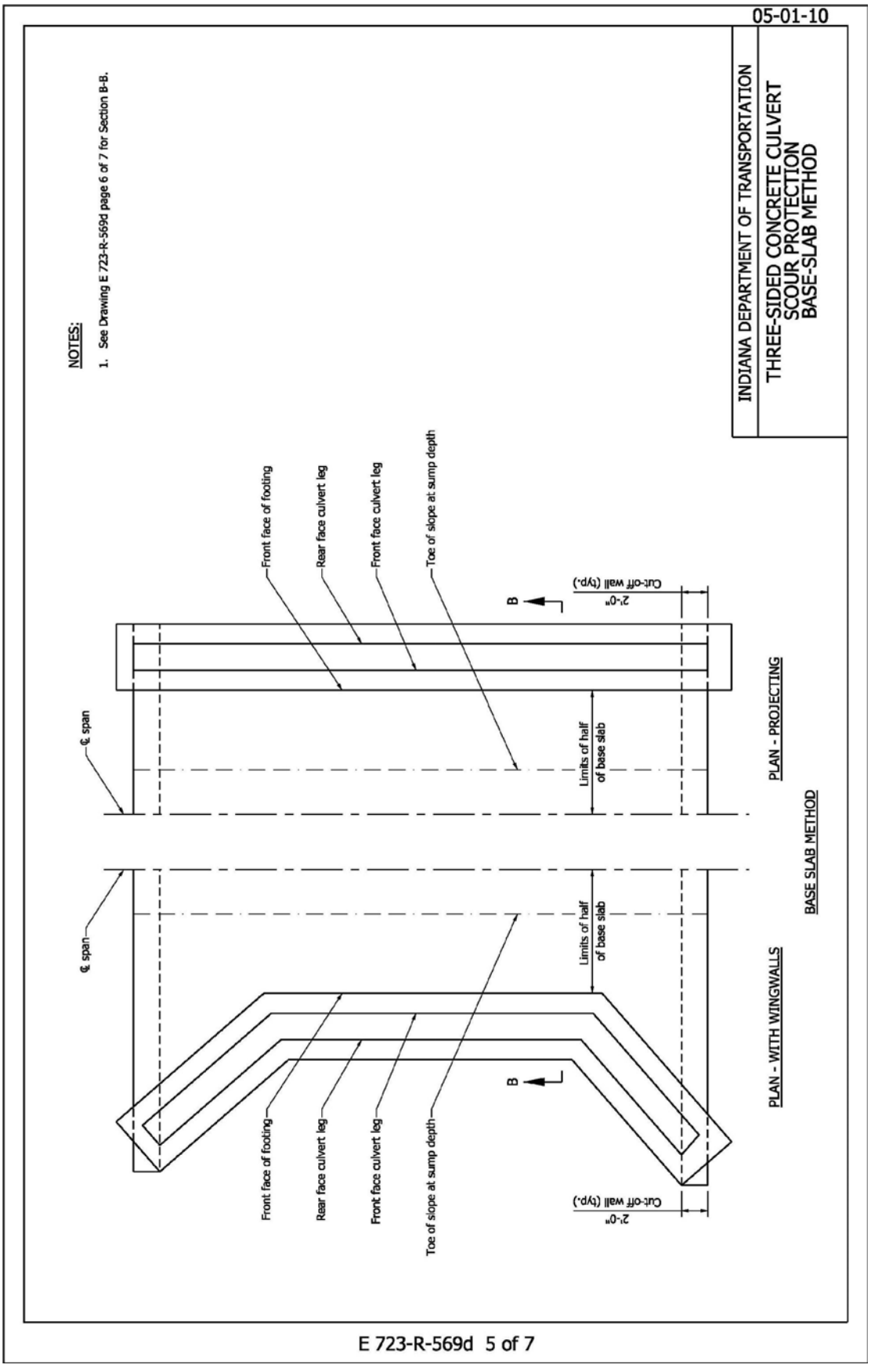
(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARD COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

714-CCSP-05 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION

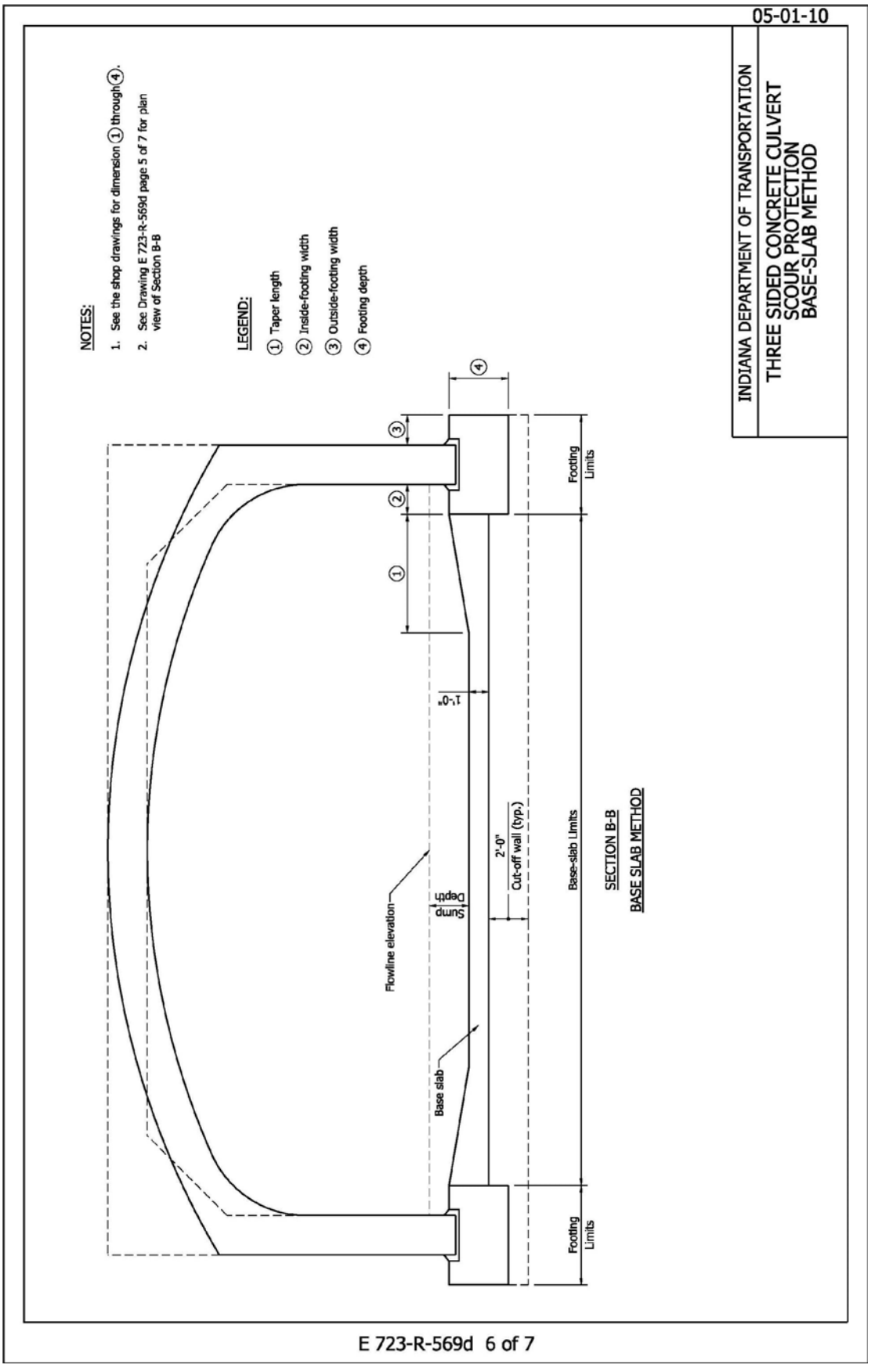
(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARD COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

714-CCSP-06 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION

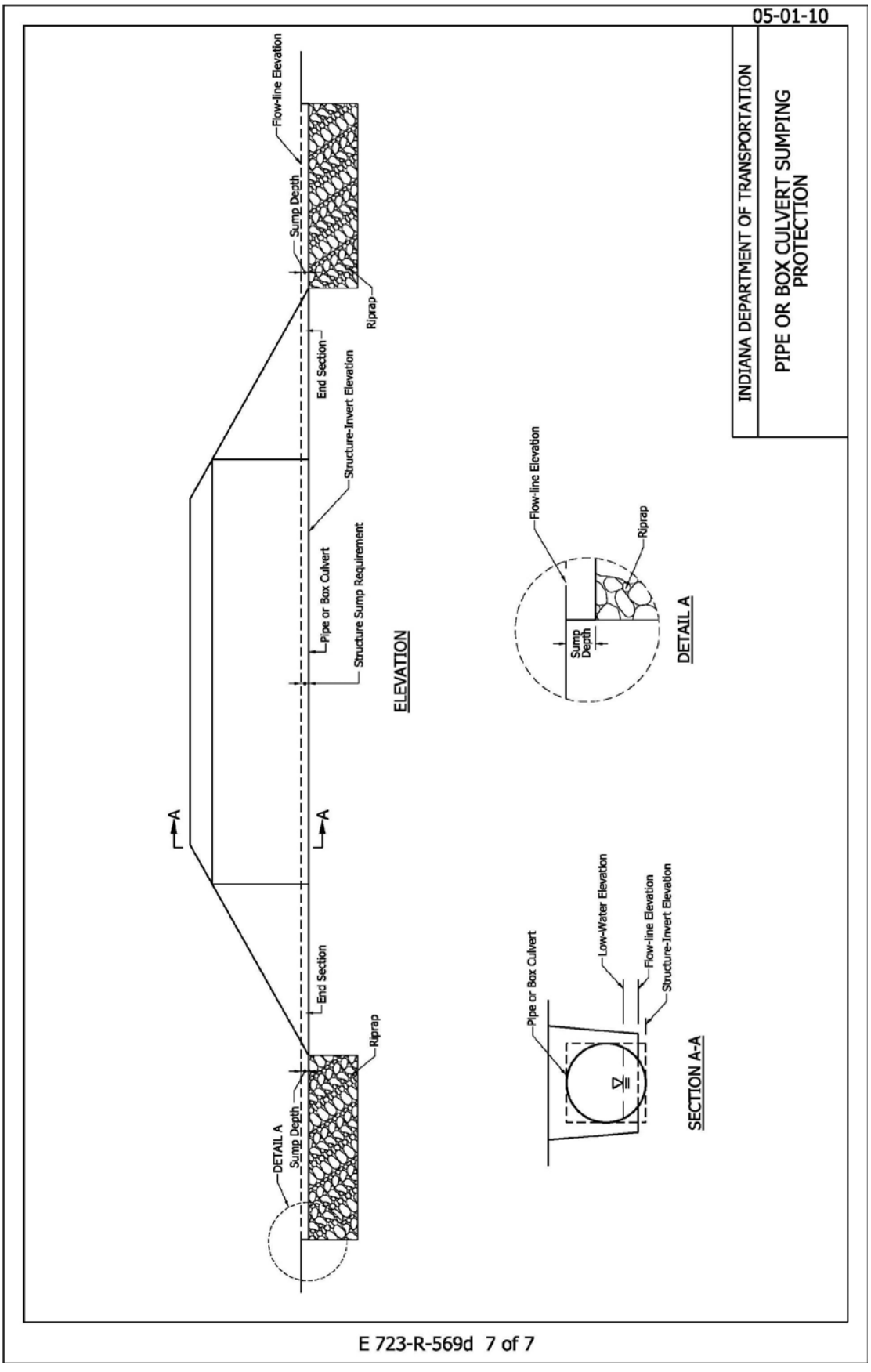
(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARD COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

715-PCSP-01 PIPE CULVERT SUMPING PROTECTION

(PROPOSED RPD 723-R-569d SCOUR PROTECTION AND SUMP DETAILS AS REVISED AT THE STANDARD COMMITTEE MEETING ON 11/19/2009)



REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

SUMMARY OF CHANGES MADE TO THE BOX CULVERT SCOUR PROTECTION DRAWINGS

STANDARDS COMMITTEE ITEM No. 03 04/19/09 (2010 SS)
REVISIONS SINCE COMMITTEE PASSAGE ON 10-15-09 AS REVISED

Agenda page 5

Plan – With Wingwalls:

Extend area of limits of scour protection within limits of structure to outer edge of footing.

Agenda page 6

Eliminate low-water-elevation indication.

Identify 1'-6" Sump Depth only as Sump Depth.

Agenda page 7

Both plan views:

Show and label neat line for scour protection, at bottom of 2:1 slope from front face of structure.

Eliminate riprap from between this line and the centerline of span.

Extend area of limits of scour protection within limits of structure to outer edge of footing.

Label 6'-0" dimension as minimum for consistency with Agenda page 8.

Plan – With Wingwalls:

Extend area of limits of scour protection within limits of structure back from new neat line for scour protection to the top of the 2:1 slope at the wingwalls.

Agenda page 8

Eliminate low-water-elevation indication.

Show and label a neat line for excavation from the toe of the 2:1 slope to the flowline elevation.

Show an arrow indicating the neat line for scour protection to also apply to the vertical riprap face at the toe of the 2:1 slope.

Agenda page 10

Show the line indicating flowline elevation as a solid line spanning the structure, for consistency with Agenda pages 2 and 4.

Show both footings as independent concrete pours from the base slab.

Show the bottom-of-footing elevations to be lower than the bottom-of-base-slab elevation.

APPROVED MINUTES

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

SUMMARY OF CHANGES MADE TO THE BOX CULVERT SCOUR PROTECTION DRAWINGS (CONTINUED)

Agenda page 11

Eliminate low-water-elevation indication.

Elevation view, right-hand side: Square up left face of riprap to correspond to point where angled line and structure-invert-elevation lines meet, for consistency with left-hand side of view.

[P:\Structural Services\Design Memos\Pending\2009\09CuSu-SC.doc]

APPROVED MINUTES

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

PROPOSED REVISION TO SECTIONS: 723.17, 723.18, 723.19

The Standard Specifications are revised as follows:

SECTION 723, BEGIN LINE 366, DELETE AND INSERT AS FOLLOWS:

723.17 Scour Protection

Scour protection shall be installed as shown on the plans.

When riprap is specified, geotextile shall first be placed on the in-situ soil in accordance with 616.11. Riprap shall then be placed in accordance with 616.

For concrete base slabs, concrete shall be placed in accordance with 702.

723.18 Method of Measurement

Structures and wingwalls will not be measured. The accepted quantities for payment will be the quantities shown on the plans.

Structure backfill will be measured in accordance with 211.09. Flowable backfill will be measured in accordance with 213.08. ~~Geotextile and riprap will be measured in accordance with 616.12.~~

723.19 Basis of Payment

The accepted quantities of structure will be paid for at the contract unit price per linear foot (meter) for structure, precast three-sided, of the span and rise specified. The accepted quantities of wingwalls will be paid for at the contract unit price per square foot (square meter) for wingwalls. Structure backfill will be paid for in accordance with 211.10. Flowable backfill will be paid for in accordance with 213.09. ~~Geotextiles and riprap will be paid for in accordance with 616.13.~~

If a four-sided precast concrete box structure is substituted for the three-sided structure shown on the plans, it will be paid for as structure, precast, three-sided, of the span and rise shown in the Schedule of Pay Items.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Structure, Precast Three-Sided, _____ (span) in. x _____ (rise) in. (_____ (span) mm x _____ (rise) mm)	LFT (m)
Wingwall	SFT (m2)

The cost of designing, coring, testing, pedestals or extended legs, reinforcement, excavation, *scour protection,* repairs, plugging core and handling holes, mortar, sealer, and necessary incidentals shall be included in the cost of the structure.

APPROVED MINUTES

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

PROPOSED NEW SECTION: IDM 31-3.04(07) CULVERT SUMPING AS REVISED AT THE STANDARDS COMMITTEE MEETING ON 11/19/2009

31-3.04(07) Culvert Sumping

Sumping a drainage structure consists of placing the structure invert elevation and scour protection at a specified depth below the waterway or stream flowline to satisfy the IDEM Water Quality Section 401 permit requirements. This sumping allows the natural movement of stream bed material through the structure. Sumping should be provided for each structure over one of the Waters of the United States.

1. Three-Sided Structure. The sump depth should be 18 in. for a stream bed of sand, 12 in. for a stream bed of other soil, or 3 in. for a stream bed of rock or till. The stream bed and scour protection should be as shown on the INDOT *Standard Drawings* 723-CCSP series. The use of a base slab should be determined as described in Section 31-4.05(03) item 6. No increase in structure size is required due to sumping. The sump area will not require backfill as part of the contract work, but will be allowed to fill in naturally over time.

2. Pipe or Box Structure. Such a structure should be sumped as shown on INDOT Standard Drawing 715-PCSP-01 and Figure 31-3A(1).

Structure Diameter or Span, S (ft)	Sump Required for Stream Bed of Sand (in.)	Sump Required for Stream Bed of Other Soil (in.)	Sump Required for Stream Bed of Rock or Till (in.)
< 4	6	3	3
$4 \leq S < 12$	12	6	3
$12 \leq S < 20$	18	12	3

PIPE OR BOX STRUCTURE SUMP REQUIREMENT

Figure 31-3A(1)

If the required sump exceeds 3 in., the structure diameter or rise may need to be increased by the sump value. The structure's design capacity should be checked to determine if such increase is required. If a pipe end section or riprap is required, these should be sumped to the same depth as the structure. The sump area of the structure and end section or riprap will not require backfill as part of the contract work, but will be allowed to fill in naturally over time.

APPROVED MINUTES

REVISION TO THE STANDARD DRAWINGS AND STANDARD SPECIFICATIONS

PROPOSED NEW SECTION: IDM 31-3.04(07) CULVERT SUMPING AS REVISED AT THE STANDARDS COMMITTEE MEETING ON 11/19/2009 (CONTINUED)

Scour-protection limits should be shown on the plans. Quantities for geotextile and riprap, or a base slab, should be determined and shown in the Structure Data table for each applicable structure. Appropriate columns have been incorporated into the Structure Data table. Such quantities are not pay quantities, and therefore should not be incorporated into other pay quantities of geotextile, riprap, or concrete.

APPROVED MINUTES

BACKUP No. 1

DESIGN DIVISION. MEMORANDUM

INDIANA DEPARTMENT OF TRANSPORTATION
DESIGN DIVISION
INDIANAPOLIS, INDIANA 46204-2249
INTER-DEPARTMENT COMMUNICATION

August 3, 2009

MEMORANDUM

TO: Anne M. Rearick
Structural Services Manager

FROM: Merril E. Dougherty
Hydraulics Supervisor

SUBJECT: **REVISED** Proposed Standard Drawing Revisions and Design Manual Culvert Policy Change to meet IDEM Culvert Sumping Requirement.

IDEM as part of the 401 permitting process has a requirement that culvert structures be sumped 20%. The proposed changes to the 3-sided concrete culvert standard drawings and the culvert sumping policy changes for Chapter 31 "Culverts" of the IDM have been reviewed by the hydraulics staff, OES and IDEM. The original 20% sumping requirement by IDEM was estimated to cost INDOT $1 million per year. This package reflects the changes I have proposed to the 3-sided culvert scour protection standards drawings to meet the IDEM requirement without any increase in structure size or cost. The sumping requirements for culverts with bottoms reflect the reduced requirements after discussions with IDEM. With these changes implemented it is roughly estimated that it will cost INDOT $300K to $400K per year. This is a significant reduction over the original requirement cost of $1M per year. Designers are currently left with out guidance for addressing the IDEM requirement so it is recommended that the standard drawing recommendation become effective ASAP. The design manual information should apply to projects that are submitted for Stage 1 review after June 1 2009. The information should be transmitted by a standards memorandum.

Thank you for your consideration of this item. If you have any questions please let me know.

MED

cc: file

APPROVED MINUTES

COMMENTS AND ACTION

714-CCSP-01 THROUGH -06 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION
715-PCSP-01 PIPE CULVERT SUMPING PROTECTION
REVISION TO 723.17, 723.18, 723.19
REVISION TO IDM 31-3.04(07) CULVERT SUMPING

NOTE: The proposed Standard Drawing sheets and proposed IDM revision pages were replaced with a handout at the meeting. Those handout sheets will be included in a final draft of these minutes.

DISCUSSION: Tony Uremovich distributed an 8 page handout that superseded the proposed standard drawings and design policy. The changes to each drawing and design policy were then discussed. It was noted that geotextile and riprap were no longer called out on the standard drawings but rather the term “scour protection” is used.

Tom Caplinger raised a few questions regarding defining the sumping depth. Merril Dougherty replied that this information is defined in the design manual, figure 31-3A(1). After additional discussion, it was agreed to revise the drawings to not show a sumping depth on the drawings but rather call it “sump depth”. The required sump depth will be provided in the design manual; figure 31-3A(1) and corresponding text will be revised.

Ron Heustis commented to the committee that the designer is still responsible to show the estimated quantity of riprap & geotextile on plans, even though it is considered scour protection, is incidental to the construction of the culvert, and will not be paid for separately.

Because this will be a change in the way scour protection is paid, Ron Heustis and Jim Keefer recommended sending out a construction memorandum describing this change to the field personnel. Furthermore, there is no conflict even though there are pay items for riprap and geotextile in the *Standard Specifications* because riprap and geotextile used in conjunction with culverts is identified on the standard drawings and proposed specification as scour protection.

Paul Berebitsky expressed concern from Industry regarding paying separately for riprap & geotextile vs. including cost in cost of structure. The contractors would like to keep everything as a separate pay item. Ron Heustis replied that the rationale for including this in cost of other items is that INDOT is trying to cut down on measuring and tracking some of the minor items and use this time to track major project items. Fewer pay items should result in less time involved in getting finals completed. INDOT is considering a shift in philosophy to include everything necessary to install a structure in the structure item. Committee discussion resulted in a consensus comment that this philosophy should be used on the box culverts and pipe structures as well.

Anne Rearick revised the motion to approve the standard drawings as revised and discussed at the meeting and approve the specification as submitted.

Bob Cales seconded the revised motion.

It is important to incorporate the sumping requirements ASAP to satisfy IDEM, so the drawings should be implemented as recurring plan details. Implementation date will be discussed outside this meeting.

Implementation of the specification changes can be delayed until September of 2010.

APPROVED MINUTES

COMMENTS AND ACTION (CONTINUED)

714-CCSP-01 THROUGH -06 THREE-SIDED CONCRETE CULVERT SCOUR PROTECTION
715-PCSP-01 PIPE CULVERT SUMPING PROTECTION
REVISION TO 723.17, 723.18, 723.19
REVISION TO IDM 31-3.04(07) CULVERT SUMPING

Note: Recurring Special Provision will be held until September 01, 2010 to allow revision to the sections 714 and 715 related to the Scour Protection to be included at the same time.

APPROVED MINUTES

Motion: Ms. Rearick
Second: Mr. Cales
Ayes: 10
Nays: 0

Standard Specifications Sections affected:
723.17
723.18
723.19

Recurring Special Provision affected:
None

Standard Sheets affected:
714-CCSP-01
714-CCSP-02
714-CCSP-03
714-CCSP-04
714-CCSP-05

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

_X_ 2012 Standard Specifications Book

_X_ Create RSP (No. 723-R-568)
Effective Sep. 01, 2010 Letting
RSP Sunset Date: _____

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

Standard Drawing Effective Sep.01, 2010
_X_ Create RPD (No. 723-R-569d)
Effective May 01, 2010 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? _X_

SPECIFICATION REVISIONS

REVISION TO THE STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

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

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

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

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

APPLICABLE STANDARD SPECIFICATIONS: 808, 909.05, 921

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: 76-3

APPLICABLE SECTION OF GIFE:Unknown

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

Submitted By: Todd Shields

Title: Manager, Office of Technical Services

Organization: INDOT

Phone Number: 317-233-4726

Date: September 21, 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)

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808: PAVEMENT TRAFFIC MARKINGS

SECTION 109.05.1, AFTER LINE 637, INSERT AS FOLLOWS:

(f) Pavement Traffic Markings

Quality adjustments will be calculated in accordance with 808.07

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

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 shall not apply. All other performance measures shall apply.

APPROVED MINUTES

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
Multi-Component	*921.02(c)*
~~Epoxy~~	~~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

APPROVED MINUTES

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

APPROVED MINUTES

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

(b) Lane Lines

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

(c) Edge Lines

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

(d) Barrier Lines

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

808.05 Transverse Markings

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

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

808.06 Curb Markings

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

APPROVED MINUTES

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.

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

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

Retro-reflectivity shall be measured on projects with 50,000 ft (15 000 m) or more longitudinal paint line or 10,000 ft (3 000 m) or more longitudinal durable marking line. The longitudinal lines shall meet or exceed required minimum initial and retained average retro-reflectivity measurements. All other projects and markings shall meet or exceed 75% of the required longitudinal line minimum measurements and will be measured by the Department at the discretion of the Engineer except that quality adjustments shall not apply. Retained retro-reflectivity is the value at the warranty expiration in accordance with 808.09. The retained retro-reflectivity will be measured by the Department at the discretion of the Engineer.

If a pay item, retro-reflectivity testing is included in the contract, retro-reflectivity testing equipment shall be furnished, calibrated, and operated in accordance with ITM

APPROVED MINUTES

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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.

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.

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*
	150 to 249	*125 to 174*	*0.70*		
Thermoplastic	*≥ 300*	*≥ 200*	*1.00*	*200*	*150*
	250 to 299	*150 to 199*	*0.70*		
Multi-Component	*≥ 300*	*≥ 200*	*1.00*	*200*	*150*
	250 to 299	*150 to 199*	*0.70*		
Preformed Plastic	*≥ 300*	*≥ 200*	*1.00*	*200*	*150*
	250 to 299	*150 to 199*	*0.70*		
Ext. Warranty Preformed Plastic	*≥ 650*	*≥ 450*	*1.00*	*See 808.09.1*	*See 808.09.1*
	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 f~~*F*ast 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. ~~Standard dry or f~~*F*ast dry traffic paint will only be permitted between October 1 and the following April 30.

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.~~

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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. If the final average retro-reflectivity measurement is below the required minimum or the alignment tolerances are not in

APPROVED MINUTES

compliance the segment of line will be adjudicated as failed material in accordance with 105.03.

(b) Durable Pavement Marking Material

Durable pavement marking material consists of thermoplastic, preformed plastic, or ~~epoxy~~ *multi-component markings. The markings shall only be applied between April 15 and October 31 unless otherwise requested by the Contractor and approved by the Engineer. When the markings are not placed by October 31 and when placement of the permanent markings have not been approved by the Engineer, temporary painted markings shall be applied in accordance with 801.12(a) and permanent markings shall subsequently be applied on or after April 15 of the following year. Removal of the painted markings, if deemed necessary by the Contractor, shall be performed in accordance with 808.10 prior to placement of the permanent markings. If all other work on the project is complete and all pavement lanes are open to unrestricted and safe travel, the charging of time will be suspended until May 15.*

1. Thermoplastic

a. Application

~~Thermoplastic marking material shall be used on asphalt pavements unless otherwise specified or directed. The pavement surface shall be primed with a binder material in accordance with the manufacturer's recommendations.~~ Thermoplastic marking shall be applied in molten form by ~~spray,~~ *conventional* extrusion~~, or ribbon type extrusion airless spray~~ when the pavement *and ambient air* temperature*s* ~~is~~ *are* 50°F (10°C) or above*; or by ribbon type extrusion or spray when the pavement and ambient air temperatures are 60°F (16°C) or above*. *Heat bonded preformed thermoplastic may be used for transverse or message markings.* The average *final* thickness of each 36 in. (910 mm) length of thermoplastic marking shall be no less than ~~3/32 in.~~*90 mil* (2.~~5~~*53* 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 gasps 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

APPROVED MINUTES

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, designed for the purpose of placing thermoplastic markings in accordance with the manufacturer's recommendations, may be used if approved to apply some 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 preformed plastic shall be the overlay method for both PCCP and HMA. No grooving of the pavement is required.

The installation method for extended warranty preformed plastic shall be the overlay method on PCCP and the inlay or overlay method on HMA. 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.

~~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.~~

APPROVED MINUTES

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

b. ~~Equipment~~ *Performance Requirements*

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

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

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

a. Application

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

b. Equipment

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

APPROVED MINUTES

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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. If the final average retro-reflectivity measurement is below the required minimum or the alignment tolerances are not in compliance the segment of line will be adjudicated as failed material in accordance with 105.03.

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 encapsulated lens 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:

APPROVED MINUTES

	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 or method of application. 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. *The markings will be subject to snowplowing and deicing chemicals.*

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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

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

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

808.09.1 Extended Warranty for Preformed Plastic Pavement Marking Material

When extended warranty materials are specified as a pay item the requirements herein shall be met in addition to those specified in 808.09.

The markings shall be warranted for a period of four 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*
3	*200*	*150*
4	*150*	*125*

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.

APPROVED MINUTES

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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.

APPROVED MINUTES

(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, 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

APPROVED MINUTES

patching material shall be placed in accordance with the appropriate specifications for the patching material.

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

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

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

(f) Replacement of Prismatic Reflectors

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

808.12 Method of Measurement

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

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

APPROVED MINUTES

Retro-reflectivity testing will not be measured.

Pavement Message Markings Table

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

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

808.13 Basis of Payment

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

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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 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.

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

Payment will be made under:

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

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

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

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS (CONTINUED)

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

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

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

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT

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

~~(a) Blank~~

~~(b) Fast Dry Traffic Paint~~

~~1. General Requirements~~

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

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

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

~~2. Specific Requirements~~

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

~~(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.~~

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

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

~~2. Specific Requirements~~

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

~~previously submitted samples~~

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

~~3.~~ ~~Formulation~~ ~~Approval~~

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

APPROVED MINUTES

SECTION 921 – PAVEMENT MARKING MATERIALS

921.01 ~~Traffic Paint~~ *Blank*

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

921.02 Durable Marking Material

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

(a) Thermoplastic

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

Heat bonded preformed thermoplastic shall be in accordance with AASHTO M 249 with the exception of the relevant differences due to the material being supplied in preformed state. The application properties as outlined in section 5 of AASTHO M 249 shall not apply. Drying time and short term and long term flowability requirements are not applicable at time of installation. The material shall be capable of fusing to itself and previously applied thermoplastic pavement markings when heated. The material shall contain a minimum of 30% glass beads by weight. The glass beads must be homogeneously blended throughout the material. The surface of the markings shall provide a minimum skid resistance of 45 BPN when tested in accordance with ASTM E 303. 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. *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.*

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

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.

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. The surface of the markings shall provide a minimum skid resistance of 45 BPN when tested in accordance with ASTM E 303.

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~~

APPROVED MINUTES

~~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%~~ *Multi-Component* Solids ~~Epoxy~~

~~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~~

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~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~~ ~~Yellow, Medium chrome yellow conforming to ASTM D 211, Type III~~	~~22~~ ~~25~~
~~Epoxy Resins~~ ~~White~~ ~~Yellow~~	 ~~77~~ ~~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

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~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~~

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

	~~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.~~

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~**(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~~

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~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.~~

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~(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~~

APPROVED MINUTES

~~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.~~

APPROVED MINUTES

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

~~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:*

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATIONS

REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS (CONTINUED)

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 or skid resistance 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.*

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

76-3.0 PAVEMENT MARKING MATERIALS

76-3.01 Material Types

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

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

2. Thermoplastic. Thermoplastic markings are typically made from hydrocarbon or alkyd resins, pigment and filler. The materials are heated to high temperatures and are applied in thicknesses of ~~2.~~*42.3* mm to ~~4.8~~*3.2* mm. The material is applied to the surface and, while it is still hot, glass beads are dropped onto the mixture. When the material cools, the glass beads are then bonded to the surface. Thermoplastic markings must be applied to clean, dry bituminous pavements. A primer may be required to ensure satisfactory performance. Thermoplastic markings are ~~significantly~~ more expensive than paint, but often can last ~~5~~3 or more years when applied properly. ~~Thermoplastic is the preferred marking for high-volume roadways due to its long life.~~

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

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

APPROVED MINUTES

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.

APPROVED MINUTES

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*

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

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. *<u>Location</u>. 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. *<u>Pavement Life</u>. RPM's generally should not be placed at locations that are scheduled for resurfacing or reconstruction within the pext four years.*

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

4. *<u>Traffic Volumes</u>. 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.*

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

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

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

76-3.02(06) Surface Conditions

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

APPROVED MINUTES

REVISION TO THE STANDARD SPECIFICATIONS

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

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

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

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

2 Skip lines only

RECOMMENDED PAVEMENT MARKINGS APPLICATIONS

Figure 76-3A

APPROVED MINUTES

INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT

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

APPROVED MINUTES

1.0 SCOPE.

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

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

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

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

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

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

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

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

2.0 REFERENCES.

2.1 ASTM Standards.

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

2.2 ITM Standards.

802 Random Sampling

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

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

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

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

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

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

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

5.0 APPARATUS.

APPROVED MINUTES

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.

APPROVED MINUTES

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.

APPROVED MINUTES

7.5 Letters, Symbols and Transverse Lines.

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

8.0 CALCULATIONS.

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

Average $(\bar{x})$

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

Standard Deviation (s):

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

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

where:

n = the number of measurements within each measurement sampling zone

9.0 REPORT. The report shall include the following items:

9.1 Test date and time

9.2 Date and time of application of the pavement marking

9.3 Color of and type of pavement marking

9.4 Manufacture and product name or number of each material used

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

REVISION TO THE STANDARD SPECIFICATIONS

REVISION TO ITM No.931-08T (CONTINUED)

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

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATION

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;

APPROVED MINUTES

(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.

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATION

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

c. Performance Requirements

(1) Retro-reflectivity

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

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

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

(2) Durability

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

d. Retro-reflectivity Quality Assurance Adjustments

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

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

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

APPROVED MINUTES

REVISION TO STANDARD SPECIFICATION

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

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

SECTION 808, AFTER LINE 484, INSERT AS FOLLOWS:

Retro-reflectivity testing will not be measured for payment.

SECTION 808, AFTER LINE 525, INSERT AS FOLLOWS:

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

SECTION 808, AFTER LINE 536, INSERT AS FOLLOWS:

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

SECTION 808, AFTER LINE 541, INSERT AS FOLLOWS:

Retro-reflectivity Testing ..... LS

SECTION 909, AFTER LINE 516, INSERT AS FOLLOWS:

(d) Cold Temperature White and Yellow Waterborne Traffic Paint

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

APPROVED MINUTES

COMMENTS AND ACTION

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS
REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT
REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS
REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A
REVISION TO ITM No.931-08T

DISCUSSION: Todd Shields commented that this is a performance based painting specification. Ron Heustis requested that the committee go through changes one at a time, page by page. Industry representatives were present and inquired if they should also comment page by page and they were directed to do so.

References to glass beads need to be replaced with beads. Also references to adjudicated by failed materials committee need to be removed as this is addressed elsewhere in the Standard Specifications.

Dave Andrewski questioned that fast dry paint is mentioned in the specification, but all the 900 material specifications have been deleted. Todd Shields replied that the intent is that you can use whatever paint you want just meet the specification requirements. Dave Andrewski replied that INDOT needs to know what is in the paint because paint has been applied that is “eating” the pavement. Rick Smith commented on the shrinkage of waterbourne paint phenomenon and that this could be the cause because waterbourne paint shrinks when applied to asphalt. Dave Andrewski indicated that the pavement is being “eaten” down to the intermediate course and commented that he believes it to be toluene based paint. Dave then repeated his initial concern that INDOT needs to have material specifications.

Joe Novak, Ron Heustis, and Doug Nagel discussed pay items for retro-reflectivity. It was decided to remove retro-reflectivity as a pay item.

Paul Berebitsky inquired if manufacturers were certifying individuals as a certification is required in 808.07(c). Todd Shields replied that manufacturers are certifying individuals.

Paul Berebitsky inquired about the sampling zone. The committee commented that there is only one sampling zone.

Jim Keefer commented that often there are questions on payment when there is a project delay and the permanent markings are not placed by the stated date and temporary markings are required. Who is responsible for payment? A comment was received that if the delay is the owner’s fault, the owner pays, if the delay is the contractor’s fault, the contractor pays. Mark Miller questioned why not go with temperature instead of hard date as temperature is the controlling factor on permanent marking placement? Doug Nagel commented that the traffic line marking contractors are waiting for that one good day late in the season and if/when it occurs they are supposed to be in 75 places at once. Doug expressed concern with the 30 day window in the spring and the traffic line marking contractors are being asked to put out a quality product but weather is generally poor. He suggested adding 15 days to this window and extend it from May 15 to June 1. Joe Novak indicated that he will revisit this.

Relating to the above discussion, Paul Berebitsky mentioned that prime contractors have concern about liability for jobs that go over the winter and that the prime contractor is typically named in lawsuits when there is an accident on a project. Paul Berebitsky suggested staggering the cutoff date to recognize the weather variability for the northern districts, central districts, and southern districts. He had some historical weather information for various cities in Indiana and mentioned what historically has been the last 50° day for the year. These dates were November 12 for Fort Wayne and LaPorte Districts, November 20 for Crawfordsville and Greenfield Districts, and November 30 for Seymour and Vincennes Districts.

APPROVED MINUTES

COMMENTS AND ACTION (CONTINUED)

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS
REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT
REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS
REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A
REVISION TO ITM No.931-08T

Todd Shields commented to delete encapsulated lens from the sheeting.

Jim Keefer and Greg Pankow proposed revising the language in 808.09 to make it clearer that the warranty needs to include the action of snow plows or de-icing chemicals. Doug Nagel replied that thermoplastic is the most exposed to plowing and is the most damaged. Doug also commented that the manufacturers recommend recessing the pavement markings to better enable them to withstand plowing.

Joe Novak recommended removing the language in 808.09.1 regarding requiring a warranty bond. Joe commented that this would require INDOT to have someone track and periodically inspect these projects.

Todd Shields requested to delete the requirement for taking care when removing the snowplowable marker base during removal as these markers are no longer desired by INDOT.

Doug Nagel and Ron Heustis discussed the waiving of the retro-reflectivity testing requirement as mentioned in 808.13 and whether different language is necessary. Ron commented that the Engineer may waive the testing requirements due to weather limitations. Doug commented that INDOT should recognize the manufacturer’s limits and recommendations on their products.

The committee and Industry had a discussion regarding the second last paragraph in 808.13. Industry reported that PE/S are refusing to pay for line removal based on a phrase contained in the existing specification and that there is a conflict in the existing specification. Joe Novak did not agree that there was a conflict.

COMMENTS ON THE SECTION 921:

Mark Miller questioned that if INDOT is not going to test for skid resistance, why have this language in the specification? Joe Novak replied that it was not the ad hoc committee’s intent to have INDOT testing or checking skid resistance. Ron Walker commented that he doesn’t like listing the skid number in the specification. The Committee suggested removing the skid number from the specification.

Mark Miller commented that a Type C certification is requested. A sentence should be added that instructs the contractor on what information is requested to be put on the Type C certification.

Citing the need to address the several comments and issues revealed, Todd Shields moved to withdraw this item.

APPROVED MINUTES

COMMENTS AND ACTION (CONTINUED)

REVISION TO SECTION 808 PAVEMENT TRAFFIC MARKINGS
REVISION TO SECTION 909.05 WHITE AND YELLOW TRAFFIC PAINT
REVISION TO SECTION 921 PAVEMENT MARKING MATERIALS
REVISION TO IDM 76-3, INCLUDING FIGURE 76-3A
REVISION TO ITM No.931-08T

APPROVED MINUTES

Motion: Mr. Shields Second: Mr. Andrewski Ayes: Nays:	Action: _____Passed as Submitted _____Passed as Revised __X__Withdrawn
Other sections containing specific cross references: Section 909.05 with: 808.02 Pg.724; 808.07 Pg.727; 604.05 Pg.363; 921.01 Pg.923 Section 808 with: 108.08 Pg.84; 604.04 Pg.366; 801.12 Pg.665,666; 801.14 Pg.667; 801.17 Pg.672; 801.18 Pg.673,674; Section 921 with: 801.02 p.653; 808.02 p.724	_____ 20__ Standard Specifications Book _____Create RSP (No._____) Effective _____ RSP Sunset Date: _____ _____Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____ Standard Drawing Effective _____ _____Create RPD (No._____) Effective _____Letting _____Technical Advisory
Recurring Special Provision affected: 808-R-551 808-T-141 808-T-151 808-B-114 Standard Sheets 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? _____

Ms. Rearick
Date: 10/15/09

SPECIFICATION REVISIONS

REVISION TO THE STANDARD DRAWINGS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The weld detail information on standard drawing 701-BPIL-04 is not clear. It is widely reported that the beveled edge is not being placed on the piling, nor is the gap being provided prior to welding. The lack of a beveled edge or gap between the piles may be a cause of recent welded splice failures.

PROPOSED SOLUTION: Add a "blown up" detail of the weld area showing the beveled edge on the upper pipe pile and the space that is supposed to be between the piles being spliced. Incorporating this detail on the Standard Drawing will help clarify the weld detail to the PE/S since very few individuals have knowledge of or access to the AWS Bridge Welding Code to know what the B-U4a weld symbol shown on the current drawing indicates or requires.

APPLICABLE STANDARD SPECIFICATIONS: None

APPLICABLE STANDARD DRAWINGS: 701-BPIL-04 & E701-BPIL-04

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE:None

APPLICABLE RECURRING SPECIAL PROVISIONS:None

Submitted By: Anne Rearick

Title: Manager, Office of Structural Services

Organization: INDOT

Phone Number: 2-5152

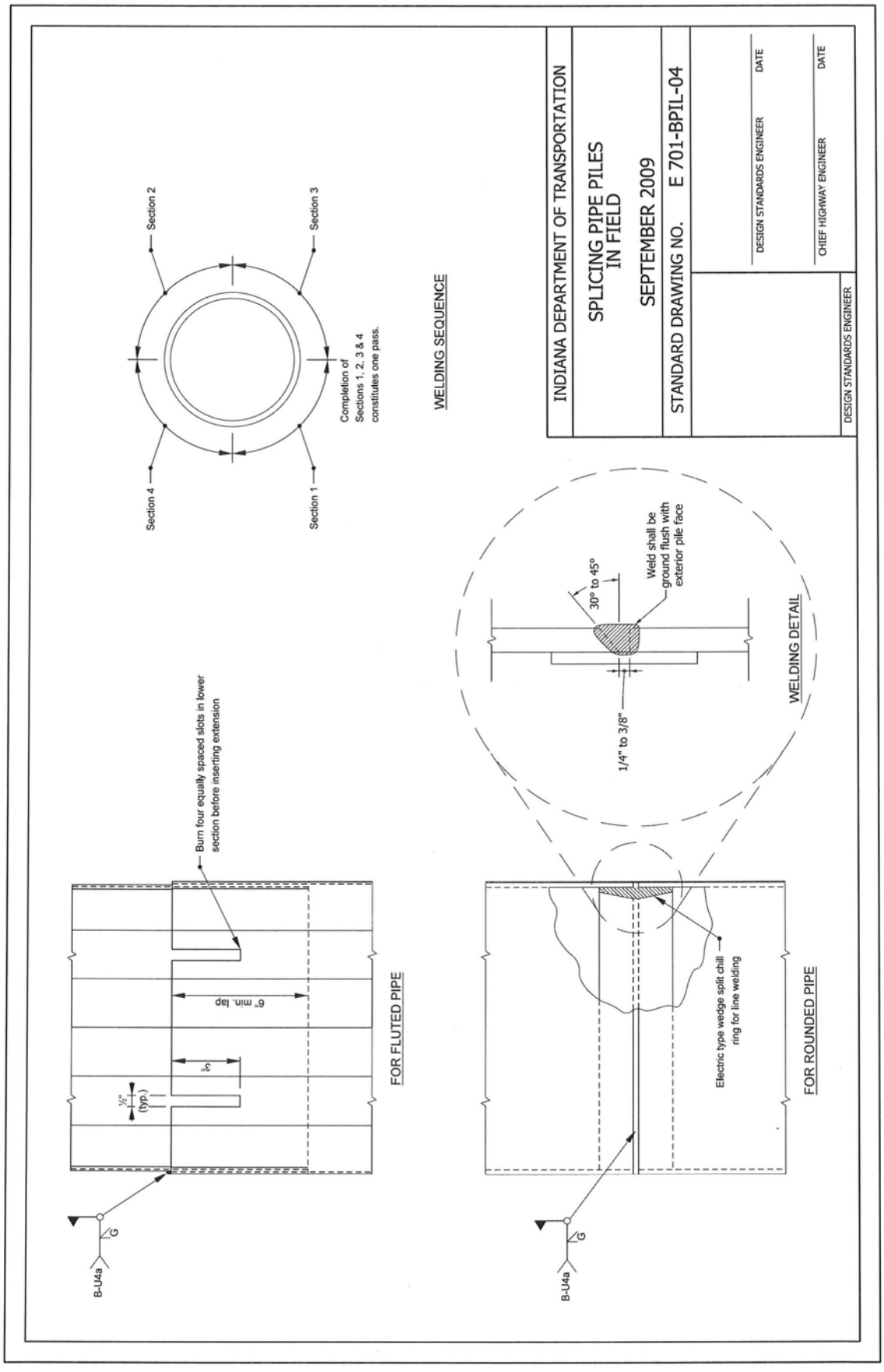
Date: September 21, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? Adding this additional information to the current standard drawing was discussed between Anne Rearick, Jim Reilman, Tony Uremovich and Mir Zaheer.

APPROVED MINUTES

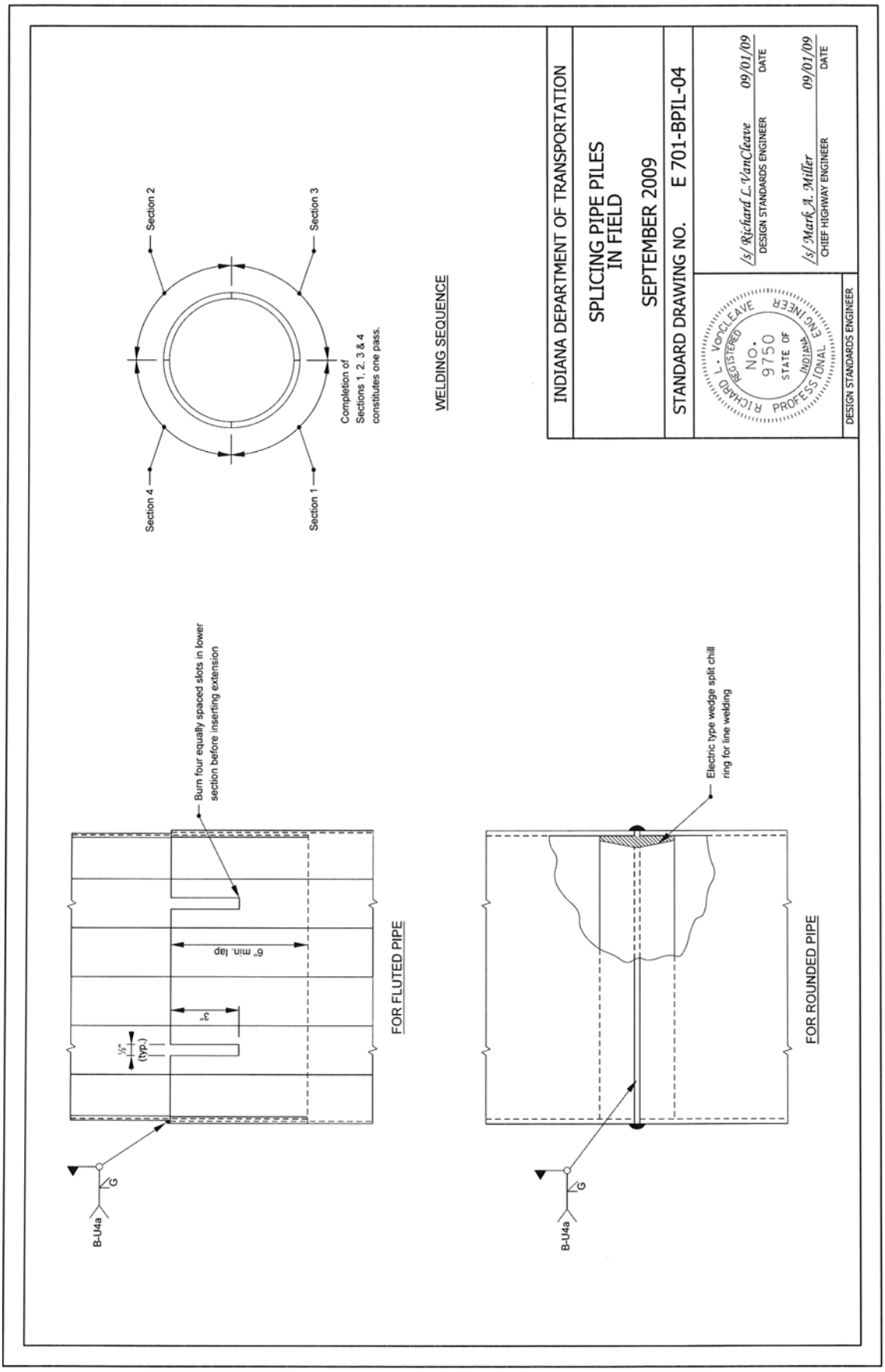
REVISION TO THE STANDARD DRAWINGS

701-BPIL-04 SPLICING PIPE PILES IN FIELD
(PROPOSED STANDARD DRAWING REVISION)



REVISION TO THE STANDARD DRAWINGS

BACKUP No. 1:701-BPIL-04 SPLICING PIPE PILES IN FIELD
(EXISTING STANDARD DRAWING)



COMMENTS AND ACTION

701-BPIL-04 SPLICING PIPE PILES IN FIELD

DISCUSSION: Greg Pankow commented that the section of the split chill ring shown on the existing standard drawing does not match the detail view.

Ron Heustis commented that instead of showing this as “welding detail” isn’t this really a section view and should be labeled as such.

Greg Pankow inquired what a split chill ring is.

Due to some concerns regarding the split chill ring, Anne Rearick moved to withdraw this item.

APPROVED MINUTES

Motion: Ms. Rearick Second: Mr. Cales Ayes: Nays:	Action: _____ Passed as Submitted _____ Passed as Revised _X_ Withdrawn
Other sections containing specific cross references: None	_____ 20__ Standard Specifications Book _____ Create RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Recurring Special Provision affected: None	_____ Revise RSP (No._____) Effective _____Letting RSP Sunset Date: _____
Standard Sheets affected: 701-BPIL-04 E701-BPIL-04	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? _____