INDIANA DEPARTMENT OF TRANSPORTATION

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Eric Holcomb, Governor
Joe McGuinness, Commissioner

AGENDA

January 17, 2019 Standards Committee Meeting

MEMORANDUM

January 7, 2019

TO: Standards Committee

FROM: Scott Trammell, Secretary

RE: Agenda for the January 17, 2019 Standards Committee Meeting

A Standards Committee meeting is scheduled for 09:00 a.m. on January 17, 2019 in the IGCS Building Conference Room 4&5.

The following items are listed for consideration:

A. GENERAL BUSINESS ITEMS

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

1. Approval of the Minutes from the December 18, 2018 meeting

B. CONCEPTUAL PROPOSAL ITEMS

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

(No items on this agenda)

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

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

Item No. 1 (2018 SS)	Mr. Beeson	pg 4
906.01	Joint Fillers	

Item No. 2 (2018 SS)	Mr. Beeson	pg 8
Recurring Special Provisions:		
307-R-657	CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR	
308-R-656	ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR	
416-R-638	COLD IN-PLACE RECYCLING, CIR	
417-R-655	COLD CENTRAL PLANT RECYCLING, CCPR	

Item No. 3 (2018 SS)	Mr. Boruff	pg 54
801.15(d)1	Fixed Temporary Signals	
801.15(d)2	Portable Signals	

Item No. 4 (2018 SS)	Mr. Orton	pg 61P[===-
Standard Drawings:		
(Existing, with markups)		
E 610-PRAP-01	PUBLIC ROAD APPROACH	
E 610-PRAP-02	PUBLIC ROAD APPROACH TYPE A	
E 610-PRAP-03	PUBLIC ROAD APPROACH TYPE B	
E 610-PRAP-04	PUBLIC ROAD APPROACH TYPE A & B - GENERAL NOTES	
E 610-PRAP-05	PUBLIC ROAD APPROACH TYPE A & TYPE B -TABLE OF VALUE	
E 610-PRAP-06	PUBLIC ROAD APPROACH TYPE C	
E 610-PRAP-07	PUBLIC ROAD APPROACH PAY LIMITS	
E 610-PRAP-08	PUBLIC ROAD APPROACH TYPE C - GENERAL NOTES	
E 610-PRAP-09	PUBLIC ROAD APPROACH TYPE C - TABLE OF VALUES	
E 610-PRAP-10	PUBLIC ROAD APPROACH TYPE D	
E 610-PRAP-11	PUBLIC ROAD APPROACH TYPE D GENERAL NOTES AND TABLE A	
E 610-PRAP-12	PUBLIC ROAD APPROACH TYPE D - TABLE OF VALUES	
E 610-PRAP-13	STREET OR VALLEY APPROACH HMA MAINLINE PAVEMENT	
E 610-PRAP-14	STREET APPROACH WITH PCCP OR HMA MAINLINE PAVEMENT	

(Proposed Draft)

E 610-PRAP-01	*PUBLIC ROAD APPROACH GENERAL NOTES*
E 610-PRAP-02	*PUBLIC ROAD APPROACH TYPE A*
E 610-PRAP-03	*PUBLIC ROAD APPROACH TYPE B*
E 610-PRAP-04	*PUBLIC ROAD APPROACH TYPE A & TYPE B TABLE OF VALUES*
E 610-PRAP-05	*PUBLIC ROAD APPROACH TYPE C*
E 610-PRAP-06	*PUBLIC ROAD APPROACH TYPE C TABLE OF VALUES*
E 610-PRAP-07	*PUBLIC ROAD APPROACH TYPE D*
E 610-PRAP-08	*PUBLIC ROAD APPROACH TYPE D TABLE OF VALUES*
E 610-PRAP-09	*PUBLIC ROAD APPROACH PAY LIMIT DETAILS*
E 610-PRAP-10	*STREET OR VALLEY APPROACH PCCP OR HMA MAINLINE PAVEMENT*
E 610-PRAP-11	*PUBLIC ROAD APPROACH OVERLAY PAVING TRANSITION*

Item No. 5 (2018 SS) Mr. Beeson pg 89

Recurring Special Provisions:

401-R-661	QC/QA HOT MIX ASPHALT, HMA, PAVEMENT
402-R-662	HOT MIX ASPHALT, HMA, PAVEMENT

cc: Committee Members
FHWA
ICI

Mr. Beeson
Date: 1/17/19

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: A new preformed joint material has been approved by the INDOT New Product Evaluation Committee and needs to be incorporated into the Standard Specifications.

PROPOSED SOLUTION: Update the Standard Specifications to include this additional product.

APPLICABLE STANDARD SPECIFICATIONS: 906.01

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE: None

APPLICABLE RECURRING SPECIAL PROVISIONS: None

PAY ITEMS AFFECTED: None

APPLICABLE SUB-COMMITTEE ENDORSEMENT: INDOT New Product Evaluation Committee

IMPACT ANALYSIS (attach report):

Submitted By: Jim Reilman for Matt Beeson

Title: Asst. State Materials Engineer

Organization: INDOT

Phone Number: 317-522-9692

Date: 12/6/18

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS

IMPACT ANALYSIS REPORT CHECKLIST

Explain the business case as to why this item should be presented to the Standards Committee for approval. Answer the following questions with Yes, No or N/A.

Does this item appear in any other specification sections? No

Will approval of this item affect the Approved Materials List? No

Will this proposal improve:

- Construction costs? Yes
- Construction time? Yes
- Customer satisfaction? Yes
- Congestion/travel time? NA
- Ride quality? NA

Will this proposal reduce operational costs or maintenance effort? Yes

Will this item improve safety:

- For motorists? NA
- For construction workers? NA

Will this proposal improve quality for:

- Construction procedures/processes? NA
- Asset preservation? NA
- Design process? NA

Will this change provide the contractor more flexibility? Yes

Will this proposal provide clarification for the Contractor and field personnel? NA

Can this item improve/reduce the number of potential change orders? NA

Is this proposal needed for compliance with:

- Federal or State regulations? NA
- AASHTO or other design code? NA

Is this item editorial? No

Provide any further information as to why this proposal should be placed on the Standards Committee meeting Agenda:

REVISION TO STANDARD SPECIFICATIONS

SECTION 906 - JOINT MATERIALS
906.01 JOINT FILLERS

The Standard Specifications are revised as follows:

SECTION 906.01, BEGIN LINE 3, INSERT AS FOLLOWS:

906.01 Joint Fillers

Joint fillers shall be preformed materials intended to be used in PCCP and bridge joints or as otherwise specified. Joint fillers shall be in accordance with AASHTO M 213 *or ASTM D 8139.*

COMMENTS AND ACTION

906.01 JOINT FILLERS

DISCUSSION:

Motion: Second: Ayes: Nays: FHWA Approval:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections referenced and/or affected: 906.01 pg 900.	_____ 2020 Standard Specifications _____ Revise Pay Items List
Recurring Special Provision affected: NONE	_____ Create RSP (No._____) Effective _____ Letting RSP Sunset Date:
Standard Drawing affected: NONE	_____ Revise RSP (No._____) Effective _____ Letting RSP Sunset Date:
Design Manual Sections affected: NONE	_____ Standard Drawing Effective
GIFE Sections cross-references: NONE	_____ Create RPD (No. _____) Effective _____ Letting _____ GIFE Update _____ SiteManager Update

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The current recycling RSPs had a slight error in how the corrective aggregate for volume is paid for (it had originally been included in the recycling pay item). It is making it difficult for bidding as you don't necessarily know whether corrective aggregate is needed. For CCPR, the max sieve size was creating too fine of a material. Lift thickness over 5" are difficult to compact. Also, with single lifts, it is still difficult to achieve proper smoothness. Difficulty in properly bidding 308, 416 or 417 because of not knowing if cement additive will be required prior to bidding.

PROPOSED SOLUTION: Correct how corrective aggregate is paid for. Adjust the max sieve size for CCPR. Require two lifts, with tack coat, when CCPR is greater than 5". Require milling on single lift CCPR. Adjust cement payment language for clarity.

APPLICABLE STANDARD SPECIFICATIONS:

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: N/A

APPLICABLE SECTION OF GIFE: N/A

APPLICABLE RECURRING SPECIAL PROVISIONS: 307-R-657, 308-R-656, 416-R-638, 417-R-655

PAY ITEMS AFFECTED: N/A

APPLICABLE SUB-COMMITTEE ENDORSEMENT: Recycling Committee which is represented by OMM, Pavement Division, and Industry

IMPACT ANALYSIS (attach report):

Submitted By: Matt Beeson

Title: State Materials Engineer

Organization: INDOT

Phone Number: 317-610-7251 x204

Date: 12/12/18

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

IMPACT ANALYSIS REPORT CHECKLIST

Explain the business case as to why this item should be presented to the Standards Committee for approval. Answer the following questions with Yes, No or N/A.

Does this item appear in any other specification sections? N

Will approval of this item affect the Approved Materials List? N

Will this proposal improve:

- Construction costs? N
- Construction time? N
- Customer satisfaction? N
- Congestion/travel time? N
- Ride quality? N

Will this proposal reduce operational costs or maintenance effort? Y

Will this item improve safety:

- For motorists? Y
- For construction workers? N

Will this proposal improve quality for:

- Construction procedures/processes? Y
- Asset preservation? Y
- Design process? Y

Will this change provide the contractor more flexibility? N

Will this proposal provide clarification for the Contractor and field personnel? Y

Can this item improve/reduce the number of potential change orders? Y

Is this proposal needed for compliance with:

- Federal or State regulations? N
- AASHTO or other design code? N

Is this item editorial? N

Provide any further information as to why this proposal should be placed on the Standards Committee meeting Agenda: This is to help further improve our recycling processes and make the spec book flow better and provide clarity. The referenced changes regarding ITM 804 and the frequency have been submitted to the appropriate persons.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
308-R-656 ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR
416-R-638 COLD IN-PLACE RECYCLING, CIR
417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

(Note: This RSP has been approved to be incorporated into 2020 Standard Specifications on September 20, 2018 SC meeting.
Shown here also minor editorial revisions for 2020 SS.
Proposed changes shown highlighted gray.)

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR

(Revised 09-20-18)

The Standard Specifications are revised as follows:

SECTION 307, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 307 – CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR

307.01 Description

This work shall consist of pulverizing and stabilizing an existing asphalt pavement along with existing base and subgrade materials to construct a reclaimed base course, RBC, to the approved design properties in accordance with 105.03.

307.02 Just-in-Time Training, JITT

The Engineer and Contractor are required to attend a JITT course regarding FDR and both shall mutually agree on the course instructor, course content and training site. The training class shall be conducted at a project field location convenient for all project construction personnel responsible for FDR operations and inspection to attend.

The JITT course shall be held during normal working hours and be completed not more than 14 days prior to the start of FDR operations.

The Contractor shall provide a JITT instructor experienced in the construction methods, materials and test methods associated with cement stabilized FDR. A copy of the course syllabus, handouts and presentation materials shall be submitted to the Engineer at least five business days before the course is to be taught.

307.03 Quality Control

A quality control plan, QCP, shall be submitted to the Engineer a minimum of five calendar days prior to the JITT. The QCP shall include the proposed FDR mix design; a start to finish process description including discussion on corrective action measures; a list of proposed equipment; a list of proposed QC tests and testing frequencies; the curing methods applied to the cement stabilized RBC and the stabilization process applied to the RBC and subgrade after a failed proofroll. All QC test results shall be maintained during the duration of the contract and made available to the Engineer upon request.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
308-R-656 ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR
416-R-638 COLD IN-PLACE RECYCLING, CIR
417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

QC TESTING	
Test	*Frequency[1,2]*
Depth of Pulverization	*1 per 500 ft*
Pulverized Material Gradation	*1 per 0.5 day of production*
In-place Moisture of Pulverized Material	*1 per 0.5 day of production*
Cement Application Rate	*1 per 500 ft*
Maximum Density and Moisture Content of Stabilized Material	*1 per 0.5 day of production*
Compacted In-Place Field Density	*1 per 1,000 ft*

Notes:

1. *The Contractor shall perform all QC tests within the first 500 ft after startup and after any change in the mix design.*
2. *Testing frequency is based upon linear feet of FDR laydown.*
3. *The density probe shall be no more than 2.0 in. above the bottom of the FDR treatment.*

MATERIALS

307.04 Materials

RBC shall consist of a homogenous blend of reclaimed asphalt pavement, RAP, base and subgrade materials that are combined with cement, water, and when required, recycling additives such as corrective aggregate. The cement may be dry powder or slurry with a minimum dry solids content of 60%. The actual materials used are dependent on the FDR mix design and project requirements.

Materials for use in RBC shall be in accordance with the following:

Corrective aggregate to adjust gradation or supplement material volume:

1. *Coarse or Dense Graded Aggregate, Class C or Higher 904.03*
2. *Fine Aggregate.....904.02*
3. *RAP shall be the product resulting from the cold milling or crushing of an existing asphalt pavement. The RAP coarse aggregate shall be processed so that 100% passes the 1 1/2 in. (37.5 mm) sieve.*

Portland Cement, Type I.....901.01(b)
Water.....913.01

Acceptance of the RBC will be in accordance with the Frequency Manual on the basis of a type D certification in accordance with ITM 804.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

307.05 Mix Design

The FDR mix design shall be in accordance with ITM 595 and comprised of existing RAP, existing base and subgrade materials, cement and if necessary, recycling additives. The 7-day unconfined strength shall be based on the overlay lay rate specified on the plans.

TEST	*PROCEDURE*	*REQUIREMENT*
7-Day Unconfined Strength	*ASTM D 1633, Method A*	*see notes 1, 2, 3*

Notes:

1. *300 psi minimum when an HMA overlay with a total lay rate ≥ 330 lb/sq yd.*
2. *400 psi minimum when an HMA overlay with a total 165 lb/sq yd ≤ lay rate < 330 lb/sq yd.*
3. *500 psi minimum when an HMA overlay with a total lay rate < 165 lb/sq yd or an applied seal coat surface.*

The mix design and all associated testing shall be performed using samples of the existing pavement, base and subgrade material from the project site representing the reclaiming depth, by a design laboratory that is AASHTO Material Reference Laboratory, AMRL, accredited for soil, aggregates, and concrete.

The sulfate content for the subgrade material shall be less than or equal to 1,000 ppm as determined in accordance with ITM 510.

Additional mix designs shall be performed when the in-place material changes significantly in order to establish representative mixes for the entire job. The Contractor shall obtain all samples required to develop the mix design. One sample per lane mile of planned RBC shall be the minimum sampling frequency for mix design preparation.

The Contractor shall provide a mix design or designs for approval at least five calendar days prior to the JITT. The mix design shall include all test results performed. If new materials are added, a new mix design, including the revised test results, shall be submitted at least one day prior to implementation.

CONSTRUCTION REQUIREMENTS

307.06 Roadway Preparation

Snowplowable raised pavement markers shall be removed in accordance with 808.11(e) prior to FDR operations.

Grass and other vegetation shall be removed from the edge of the existing pavement to prevent contamination of the RBC during milling operation.

Grade adjustments of existing structures shall be made in accordance with 720.04 except existing structures shall be lowered prior to FDR operations, properly covered and filled with material compatible with the FDR mix design to maintain traffic.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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All areas of soft or yielding subgrade, as shown on the plans, shall be corrected prior to pulverization operations.

307.07 Equipment

The equipment shall be capable of pulverizing the existing asphalt pavement, base and subgrade materials. The equipment used for mixing the pulverized materials with cement, water, additives and corrective aggregate, when required, shall be capable of producing a homogenous and uniformly blended RBC. The equipment used for placement of the RBC shall be capable of placement in accordance to 105.03.

The equipment shall consist of the following major components:

(a) Spreaders and Distributors

Spreaders or distributors used to apply dry powder additives shall be non-pressurized mechanical vane-feed, cyclone or screw type capable of providing a consistent, accurate and uniform distribution of material while minimizing dust during construction. Corrective aggregate, when required, may be placed by a mechanical spreader, a conventional paver or by tailgating with end dump trucks and spread to a uniform thickness with a motor grader.

(b) Additive Slurry Storage and Supply Equipment

Slurry shall be produced using a batch or continuous-flow type stationary mixer equipped with calibrated metering and feeding devices that introduce the cement, water and additives into the mixer in the specified quantities. Additive slurry storage and supply equipment shall have agitators or similar equipment to keep the slurry in suspension when held in the slurry batch or storage tanks. Slurry shall be kept in suspension during transport using agitator equipment.

(c) Mixing and Reclaiming Equipment

Only self-propelled, high powered, minimum 500 hp rotary mixers or reclaimers capable of mixing in-place to the depth specified shall be used. The minimum cutting drum width shall be 7 ft and fitted with cutting teeth capable of trimming earth, aggregate and HMA and be so designed that they may be accurately adjusted vertically and held in-place. The machine shall not weigh less than 25,000 lbs and shall have the strength and rigidity so that it shall not develop a center deflection of more than 1/8 in.

The mixer or reclaimer shall be fitted with an integrated water injection system capable of introducing the water into the cutting drum during the mixing process. The metering device shall be capable of automatically adjusting the flow of material to compensate for any variation in the amount of reclaimed material introduced into the mixing chamber. The water shall be calculated on a volumetric basis tied to a speed gauge,

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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ft/min, using a calibrated meter that is capable of accurately measuring the amount of material to within 0.5% of the rate required. Automatic digital readings shall be displayed for both the flow rate and total amount of reclaimed material in appropriate units of weight and time.

(d) Motor Grader

A motor grader for pre-shaping, aerating, spreading and final shaping of the material shall be utilized. The motor grader shall have a cross slope indicator.

(e) Compaction Equipment

The RBC shall be compacted using self-propelled rollers. The number, weight and types of rollers shall be as necessary to obtain the required compaction throughout the entire RBC thickness. The rollers may be used in any combination and may include a pneumatic tire roller, an 84 in. wide drum vibratory pad-foot roller equipped with a knockdown blade or a 10 t minimum single or double drum vibratory steel roller.

(f) Water Trucks

A water truck shall be used for supplying water to the reclaimer or roadway for the addition of moisture during the reclaiming operation. The water truck shall be capable of providing a controlled and consistent spray without eroding or otherwise damaging the compacted RBC.

307.08 Weather Limitations

FDR operations shall be performed when the ambient temperature is 40°F or above. The FDR shall not be performed when the soil, aggregate, or subgrade is frozen or when freezing temperatures are anticipated within seven days of the end of RBC placement. The Engineer may restrict work when the heat index is greater than 100°F. The FDR shall not be performed before May 1st or after October 1st.

307.09 Pulverization

The existing pavement shall be pulverized and stabilized in separate operations. Corrective aggregate, when required, shall be spread onto the existing surface using a mechanical spreader, a conventional paver or by tailgating with end dump trucks and spread to a uniform thickness with a motor grader. The pre-determined full depth of asphalt pavement, base and subgrade materials shall be pulverized, along with the corrective aggregate, to a homogenous mixture. The mixture may be brought to the desired moisture content during this process by means of surface application or through the mixing or reclaiming equipment's integrated fluid injection system for dust control. The base course shall not contain roots, sod, topsoil, weeds, wood or any material deleterious to its reaction with the cement stabilizer.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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For cement stabilized RBC, the pulverization shall produce a gradation that has 100% passing the 2 in. (50 mm) sieve and ≥ 55% passing the No. 4 (4.75 mm) sieve.

When a paving fabric is encountered during the pulverization operation, the Contractor shall make the necessary changes in equipment or operations so that incorporation of shredded fabric into the RBC does not affect the performance parameters or inhibit placement or compaction of the RBC. The Contractor shall be required to remove and properly dispose of oversized pieces of paving fabric. The Contractor shall make the necessary adjustments in equipment or operations so that the shredded fabric in the recycled material is no more than 5 sq in. No fabric piece shall have a dimension exceeding a length of 4 in.

Rubberized crack filler, durable pavement markings, loop wires, and other non-pavement materials shall be removed as observed from the roadway during the pulverization process. Residual materials that cannot be completely removed may be incorporated into the mixture if the Contractor can demonstrate that those added materials will not adversely affect performance.

Any such materials retained in the mixture shall be appropriately sized and blended so as to not adversely affect the strength of the RBC.

307.10 Stabilization

The cement used to stabilize the RBC may be dry powder or slurry and the Contractor shall address the application methods and fugitive dust control procedures in the QCP when dry powder materials are used. The pulverized surface shall be scarified or knifed prior to applying materials in slurry form to prevent runoff or ponding. Any dry additives used shall be spread onto the pulverized surface using a mechanical spreader. The pulverized material shall be mixed with the stabilizer and additives as required by the mix design to create a homogeneous RBC.

The in-place moisture content of the material shall be within - 1% to + 2% of the design moisture content as determined by the mix design.

Cement stabilizing materials shall have an application tolerance determined by adding ± 0.5% to the percent total cement content.

The cement shall be incorporated into the pulverized material at the initial rate determined by the mix design and approved by the Engineer. Sampling and mix design may determine different levels of cement at various portions of the project.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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The Contractor can request the cement percentage to exceed the upper tolerance provided the mix design requirements are satisfied at the requested percentage. The request will be subject to approval by the Engineer.

307.11 Control Strip and Compaction

A minimum 500 ft long control strip shall be conducted on the first day of production to verify the construction process meets the requirements as specified. The control strip shall allow the Contractor to:

(a) demonstrate the equipment, materials and processes proposed can produce a RBC layer in accordance with specification requirements;

(b) determine the optimal rates for the cement, water and any additives recommended for the reclaimed material;

(c) determine the sequence and manner of rolling necessary to obtain strength requirements in one uniformly compacted layer.

The RBC density shall be achieved with the same equipment, materials, construction methods and density requirements used on the accepted control strip. A new control strip shall be constructed if changes are made outside the tolerances of the original mix design, equipment or construction methods.

The processed material shall be uniformly compacted in one layer to a minimum of 95% of the maximum density. Maximum density shall be determined in accordance with AASHTO T 180 at the required QC frequency from a representative sample collected after the cement has been added and mixed into the pulverized material but prior to compaction.

Compaction shall be monitored in accordance with AASHTO T 310 in the direct transmission mode and continue to reach a minimum of 95% of the established maximum density during the control strip and for the remainder of the compaction operation.

Compaction equipment shall be in accordance with 307.07(e). Initial compaction shall be within 500 feet of the reclaiming unit using either a vibratory pad-foot roller, a pneumatic tire roller or a combination of the two. The pass counts shall continue to increase until the cleat indentations from the pad-foot roller are no more than 3/16 in. in depth and light can be seen between the pad-foot and RBC interface or there are no wheel impressions from the pneumatic tire roller remaining in the RBC.

The cement stabilized material shall be bladed and shaped by a motor grader in accordance with 307.07(d) to remove any remaining roller marks or indentations then leveled in accordance with 301.07. The profile grade and cross section of the RBC shall

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be finished within a tolerance of ± 1/2 in. from the plan RBC elevation prior to profile milling.

Intermediate and final compaction shall be applied to the bladed and shaped RBC using either a pneumatic tire roller, a single or double drum vibratory steel roller or a combination of the two. Finish rolling shall not be performed in vibratory mode. The compaction operation shall be performed while the RBC remains in a workable condition and continued until roller marks no longer appear.

Any type of rolling effort that causes cracking, displacement or other type of pavement distress shall be discontinued until such time as the problem can be resolved and approved by the Engineer.

The QC technician shall be on site, observing all compaction efforts and approving areas as they reach minimum relative compaction. Care shall be taken not to over compact the mat.

All tests shall be conducted at the stated QC testing frequencies throughout FDR operations.

307.12 Opening to Traffic

Opening to traffic shall occur after sufficient cure time has been applied to the RBC so traffic will not initiate raveling or permanent deformation. All loose particles that may develop on the pavement surface shall be removed by a rotary power broom in accordance with 409.

After opening to traffic, the surface of the RBC shall be maintained in a condition suitable for the safe movement of traffic.

307.13 Maintenance

The Contractor shall maintain the RBC in a satisfactory manner until the surface course has been constructed.

Any damage to the completed recycled material shall be repaired by the Contractor prior to the placement of new HMA or final surface sealing. Patching shall be in accordance with 304. The excavated patch areas shall be filled and compacted with HMA or RBC material as directed by the Engineer. No direct payment will be made for damage or repair unless approved by the Engineer.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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307.14 Curing

The planned method and duration of curing for cement stabilized RBC shall be in accordance with the QCP. The specified surface course shall be placed within two weeks of the RBC final cure, but no later than November 1.

Before placing the final surfacing, the cement stabilized RBC shall remain in-place for a minimum of three days.

Cement stabilized RBC shall be cured to minimize moisture loss from the surface for a time period that achieves the minimum required 7- day unconfined strength.

307.15 Proofrolling

The cement stabilized RBC shall be proofrolled in accordance with 203.26 using a tandem or tri-axle dump truck loaded to the legal limit and operated between 2 to 4 mph over the RBC. The Engineer will determine the limits for any area that has deflection or rutting greater than 1/2 in.

The Contractor shall rework the areas failed in proofrolling by re-pulverizing and re-stabilizing the RBC in-place at no additional cost or by removing the RBC and stabilizing the subgrade with subgrade treatment Type IC in accordance with 207.

The reworked areas shall be proofrolled for final acceptance.

In locations of failing subgrade the RBC shall be removed and subgrade treatment Type IC shall be placed in accordance with 207. HMA patching, type B shall be placed in accordance with 304.

307.16 Milling

The entire surface of the cement stabilized RBC shall be scarified in accordance with 306 to the specified cross-slope in preparation for the overlay. Construction engineering in accordance with 105.08(b) shall be provided.

307.17 Underdrain Installation

Underdrain installation in accordance with 718, when required, shall begin after having completed the proofrolling.

307.18 RBC Overlay

The overlay atop the RBC shall be as shown on the plans. The overlay shall be placed after having completed the proofrolling.

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The RBC shall be swept of all loose material and standing water with a rotary power broom in accordance with 409 immediately prior to placing the surface. The RBC shall be swept lightly to avoid damage to the RBC.

A tack coat shall be required only for the HMA overlay and shall be applied to the RBC in accordance with 406 immediately following sweeping operations.

Monuments shall be reestablished in accordance with 615.10.

307.19 Method of Measurement

The RBC will be measured by the square yard complete in place. Cement, used as stabilizing material, will be measured by the ton. Subgrade treatment will be measured in accordance with 207.05. Corrective aggregate to adjust the RBC gradation will be measured by the ton of material used. HMA patching, type B will be measured in accordance with 304.06. Milling will be measured in accordance with 306.10. Re-established monuments will be measured in accordance with 615.13. Removal of snowplowable raised pavement markers will be measured in accordance with 808.12.

307.20 Basis of Payment

The RBC will be paid for as full depth reclamation at the contract unit price per square yard, complete in place. Cement, used as stabilizing material, will be paid for at the contract unit price per ton, complete in place. Subgrade treatment will be paid for in accordance with 207.06. Corrective aggregate used to adjust the RBC gradation will be paid for at the contract unit price per ton, complete in place. HMA patching, type B will be paid for in accordance with 304.07, of the thickness specified on the plans. Milling will be paid for in accordance with 306.11. Re-established monuments will be paid for in accordance with 615.14. Removal of snowplowable raised pavement markers will be paid for in accordance with 808.13.

Payment will be made under:

Pay Item	***Pay Unit Symbol***
Corrective Aggregate, FDR	*TON*
Full Depth Reclamation	*SYS*
Stabilizing Material, Portland Cement	*TON*

The costs of the FDR mix design and QC testing shall be included in the cost of the full depth reclamation.

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The costs associated with removal of grass and vegetation, rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be included in the cost of the full depth reclamation.

The costs associated with pulverizing, stabilizing, compacting curing and maintenance of the RBC shall be included in the cost of the full depth reclamation.

The cost associated with mixing water shall be included in the cost of the full depth reclamation.

The cost associated with aggregate when used to supplement material volume shall be included in the cost of the ~~full depth reclamation~~corrective aggregate pay item.

The cost associated with aggregate when used to adjust the RBC gradation shall be included in the cost of the corrective aggregate pay item.

In the locations of failing subgrade, removal of the RBC shall be included in the cost of subgrade treatment.

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(Note: This RSP has been approved to be incorporated into 2020 Standard Specifications on September 20, 2018 SC meeting.
Shown here also minor editorial revisions.
Proposed changes shown highlighted gray.)

308-R-656 ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR

(Revised 09-20-18)

The Standard Specifications are revised as follows:

SECTION 308 – ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR

308.01 Description

This work shall consist of pulverizing and stabilizing an existing asphalt pavement and base material, excluding subgrade, to construct a reclaimed base course, RBC, to the approved design properties in accordance with 105.03.

308.02 Just in Time Training, JITT

The Engineer and Contractor are required to attend a JITT course regarding FDR and both shall mutually agree on the course instructor, course content and training site. The training class shall be conducted at a project field location convenient for all project construction personnel responsible for FDR operations and inspection to attend.

The JITT course shall be held during normal working hours and be completed not more than 14 days prior to the start of FDR operations.

The Contractor shall provide a JITT instructor experienced in the construction methods, materials and test methods associated with asphalt emulsion stabilized FDR. A copy of the course syllabus, handouts and presentation materials shall be submitted to the Engineer at least five business days before the course is to be taught.

308.03 Quality Control

A quality control plan, QCP, shall be submitted to the Engineer a minimum of five calendar days prior to the JITT. The QCP shall include the proposed FDR mix design; a start to finish process description including discussion on corrective action measures; a list of proposed equipment; a list of proposed QC tests and testing frequencies; the curing methods applied to the asphalt emulsion stabilized RBC and the stabilization process applied to the RBC and subgrade after a failed proofroll. All QC test results shall be maintained during the duration of the contract and made available to the Engineer upon request.

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QC TESTING	
Test	*Frequency[1,2]*
Depth of Pulverization	*1 per 500 ft*
Pulverized Material Gradation	*1 per 0.5 day of production*
In-place Moisture of Pulverized Material	*1 per 0.5 day of production*
Asphalt Emulsion Content	*1 per 500 ft*
Maximum Density and Moisture Content of Injected Material	*1 per 0.5 day of production*
Compacted In-Place Field Density	*1 per 1000 ft*
Field Moisture Content for Curing	*1 per each day of production*

Notes:

1. *The Contractor shall perform all QC tests within the first 500 ft after startup and after any change in the mix design.*
2. *Testing frequency is based upon linear feet of FDR laydown.*
3. *The density probe shall be no more than 2.0 in. above the bottom of the FDR treatment.*

MATERIALS

308.04 Materials

RBC shall consist of a homogenous blend of reclaimed asphalt pavement, RAP, and base materials that are combined with asphalt emulsion, water, and when required, recycling additives such as corrective aggregate or cement. Cement recycling additives used in asphalt emulsion stabilized RBC may be dry powder or slurry with a minimum dry solids content of 60%. The actual materials used are dependent on the FDR mix design and project requirements.

Materials for use in RBC shall be in accordance with the following:

Asphalt Emulsion .....902.1(b)3
Corrective aggregate to adjust gradation or supplement material volume:
1. Coarse or Dense Graded Aggregate, Class C or Higher.....904.03
2. Fine Aggregate.....904.02
3. RAP, shall be the product resulting from the cold milling or crushing of an existing asphalt pavement. The RAP coarse aggregate shall be processed so that 100% passes the 1 1/2 in. (37.5 mm) sieve.
Portland Cement, Type I.....901.01(b)
Water.....913.01

Acceptance of the RBC will be in accordance with the Frequency manual on the basis of a type D certification in accordance with ITM 804.

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308.05 Mix Design

The FDR mix design shall be in accordance with ITM 594 and comprised of existing RAP, existing base material, asphalt emulsion and if necessary, recycling additives. The mix design and all associated testing shall be performed using samples of the existing pavement and base material from the project site representing the reclaiming depth, by a design laboratory that is AASHTO Material Reference Laboratory, AMRL, accredited for soil, aggregates, HMA and asphalt emulsion.

Additional mix designs shall be performed when the in-place material changes significantly in order to establish representative mixes for the entire job. The Contractor is responsible for obtaining all samples required to develop the mix design. One sample per lane mile of planned RBC shall be the minimum sampling frequency for mix design preparation.

The Contractor shall provide a mix design or designs for approval at least five calendar days prior to the JITT. The mix design shall include all test results performed. If new materials are added, a new mix design, including the revised test results, shall be submitted at least one day prior to implementation.

CONSTRUCTION REQUIREMENTS

308.06 Roadway Preparation

Snowplowable raised pavement markers shall be removed in accordance with 808.11(e) prior to FDR operations.

Grass and other vegetation shall be removed from the edge of the existing pavement to prevent contamination of the RBC during milling operation.

Grade adjustments of existing structures shall be made in accordance with 720.04 except existing structures shall be lowered prior to FDR operations, properly covered and filled with material compatible with the FDR mix design to maintain traffic.

All areas of soft or yielding subgrade, as shown on the plans, shall be corrected prior to pulverization operations.

308.07 Equipment

The equipment shall be capable of pulverizing the existing asphalt pavement and base materials. The equipment used for mixing the pulverized materials with asphalt emulsion, water, additives and corrective aggregate, when required, shall be capable of producing a homogenous and uniformly blended RBC. The equipment used for placement of the RBC shall be capable of placement in accordance to 105.03.

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The equipment shall consist of the following major components:

(a) Spreaders and Distributors

Spreaders or distributors used to apply dry powder additives shall be non-pressurized mechanical vane-feed, cyclone or screw type capable of providing a consistent, accurate and uniform distribution of material while minimizing dust during construction. Corrective aggregate, when required, may be placed by a mechanical spreader, a conventional paver or by tailgating with end dump trucks and spread to a uniform thickness with a motor grader.

(b) Additive Slurry Storage and Supply Equipment

Slurry shall be produced using a batch or continuous-flow type stationary mixer equipped with calibrated metering and feeding devices that introduce the cement, water and additives into the mixer in the specified quantities. Additive slurry storage and supply equipment shall have agitators or similar equipment to keep the slurry in suspension when held in the slurry batch or storage tanks. Slurry shall be kept in suspension during transport using agitator equipment.

(c) Mixing and Reclaiming Equipment

Only self-propelled, high powered, minimum 500 hp rotary mixers or reclaimers capable of mixing in-place to the depth specified shall be used. The minimum cutting drum width shall be 7 ft and fitted with cutting teeth capable of trimming earth, aggregate and HMA and be so designed that they may be accurately adjusted vertically and held in-place. The machine shall not weigh less than 25,000 lbs and shall have the strength and rigidity so that it shall not develop a center deflection of more than 1/8 in.

The mixer or reclaimer shall be fitted with an integrated water and asphalt emulsion injection system capable of introducing both materials into the cutting drum during the mixing process. The metering device shall be capable of automatically adjusting the flow of material to compensate for any variation in the amount of reclaimed material introduced into the mixing chamber. The water or asphalt emulsion shall be calculated on a volumetric basis tied to a speed gauge, ft/min, using a calibrated meter that is capable of accurately measuring the amount of material to within 0.5% of the rate required. Automatic digital readings shall be displayed for both the flow rate and total amount of reclaimed material in appropriate units of weight and time.

(d) Motor Grader

A motor grader for pre-shaping, aerating, spreading and final shaping of the material shall be utilized. The motor grader shall have a cross slope indicator.

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(e) Compaction Equipment

The RBC shall be compacted using self-propelled rollers. The number, weight and types of rollers shall be as necessary to obtain the required compaction throughout the entire RBC thickness. The rollers may be used in any combination and may include a pneumatic tire roller, an 84 in. wide drum vibratory pad-foot roller equipped with a knockdown blade or a 10 t minimum single or double drum vibratory steel roller.

(f) Water Trucks

A water truck shall be used for supplying water to the reclaimer or roadway for the addition of moisture during the reclaiming operation. The water truck shall be capable of providing a controlled and consistent spray without eroding or otherwise damaging the compacted RBC.

308.08 Weather Limitations

FDR operations shall be performed when the ambient temperature is 50°F or above. The FDR shall not be performed when the soil, aggregate, or subgrade is frozen or when freezing temperatures are anticipated within seven days of the end of RBC placement. The Engineer may restrict work when the heat index is greater than 100°F. The FDR shall not be performed before May 1st or after October 1st.

308.09 Pulverization

The existing pavement shall be pulverized and stabilized in separate operations. Corrective aggregate, when required, shall be spread onto the existing surface using a mechanical spreader, a conventional paver or by tailgating with end dump trucks and spread to a uniform thickness with a motor grader. The pre-determined full depth of asphalt pavement and base materials shall be pulverized, along with the corrective aggregate, to a homogenous mixture. The mixture may be brought to the desired moisture content during this process by means of surface application or through the mixing or reclaiming equipment's integrated fluid injection system for dust control. The base course shall not contain subgrade, roots, sod, topsoil, weeds, wood or any material deleterious to its reaction with the asphalt emulsion.

For asphalt emulsion stabilized RBC, the pulverization shall produce a gradation that has 100% passing the 2 in. (50 mm) sieve and ≥ 35% passing the No.4 (4.75 mm) sieve.

When a paving fabric is encountered during the pulverization operation, the Contractor shall make the necessary changes in equipment or operations so that incorporation of shredded fabric into the RBC does not affect the performance parameters or inhibit placement or compaction of the RBC. The Contractor shall be required to remove and properly dispose of oversized pieces of paving fabric. The Contractor shall make the necessary adjustments in equipment or operations so that the shredded fabric in the

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recycled material is no more than 5 sq in. No fabric piece shall have a dimension exceeding a length of 4 in.

Rubberized crack filler, durable pavement markings, loop wires, and other non-pavement materials shall be removed as observed from the roadway during the pulverization process. Residual materials that cannot be completely removed may be incorporated into the mixture if the Contractor can demonstrate that those added materials will not adversely affect performance.

Any such materials retained in the mixture shall be appropriately sized and blended so as to not adversely affect the strength of the RBC.

308.10 Injection

An additive used in asphalt emulsion stabilized RBC may be dry powder or slurry and the Contractor shall address the application methods and fugitive dust control procedures in the QCP when dry powder materials are used. The pulverized surface shall be scarified or knifed prior to applying materials in slurry form to prevent runoff or ponding. Any dry additives used shall be spread onto the pulverized surface using a mechanical spreader. The pulverized material shall be mixed with the stabilizer and additives as required by the mix design to create a homogeneous RBC.

The in-place moisture content of the material shall be within -1% to +2% of the design moisture content as determined by the mix design.

Asphalt stabilizing materials shall have an application tolerance determined by adding ± 0.25% to the percent total asphalt emulsion content.

The asphalt emulsion shall be incorporated into the pulverized material at the initial rate determined by the mix design and approved by the Engineer. Sampling and mix design may determine different levels of asphalt emulsion at various portions of the project.

The Contractor can request the asphalt emulsion percentage to exceed the upper tolerance provided the mix design requirements are satisfied at the requested percentage. The request will be subject to approval by the Engineer.

308.11 Control Strip and Compaction

A minimum 500 ft long control strip shall be conducted on the first day of production to verify the construction process meets the requirements as specified. The control strip shall allow the Contractor to:

(a) demonstrate the equipment, materials and processes proposed can produce a RBC layer in accordance with specification requirements;

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(b) determine the optimal rates for the asphalt emulsion, water and any additives recommended for the reclaimed material;

(c) determine the sequence and manner of rolling necessary to obtain specified density requirements in one uniformly compacted layer.

The RBC density shall be achieved with the same equipment, materials, construction methods and density requirements used on the accepted control strip. A new control strip shall be constructed if changes are made outside the tolerances of the original mix design, equipment or construction methods.

The processed material shall be uniformly compacted in one layer to a minimum of 95% of the maximum density. Maximum density shall be determined in accordance with AASHTO T 180 at the required QC frequency from a representative sample collected after injection but prior to compaction.

Compaction shall be monitored in accordance with AASHTO T 310 in the direct transmission mode and continue to reach a minimum of 95% of the established maximum density during the control strip and for the remainder of the compaction operation.

Compaction equipment shall be in accordance with 308.07(e). Initial compaction shall be within 500 feet of the reclaiming unit using either a vibratory pad-foot roller, a pneumatic tire roller or a combination of the two. The pass counts shall continue to increase until the cleat indentations from the pad-foot roller are no more than 3/16 in. in depth and light can be seen between the pad-foot and RBC interface or there are no wheel impressions from the pneumatic tire roller remaining in the RBC.

The asphalt emulsion stabilized material shall be bladed and shaped by a motor grader in accordance with 308.07(d) to remove any remaining roller marks or indentations then leveled in accordance with 301.07. The profile grade and cross section of the RBC shall be finished within a tolerance of ± 1/2 in. from the plan RBC elevation prior to profile milling.

Intermediate and final compaction shall be applied to the bladed and shaped RBC using either a pneumatic tire roller, a single or double drum vibratory steel roller or a combination of the two. Finish rolling shall not be performed in vibratory mode. The compaction operation shall be performed while the RBC remains in a workable condition and continued until roller marks no longer appear.

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Any type of rolling effort that causes cracking, displacement or other type of pavement distress shall be discontinued until such time as the problem can be resolved and approved by the Engineer.

The QC technician shall be on site, observing all compaction efforts and approving areas as they reach minimum relative compaction. Care shall be taken not to over compact the mat.

All tests shall be conducted at the stated QC testing frequencies throughout FDR operations.

308.12 Opening to Traffic

Opening to traffic shall occur after sufficient cure time has been applied to the RBC so traffic will not initiate raveling or permanent deformation. All loose particles that may develop on the pavement surface shall be removed by a rotary power broom in accordance with 409.

After opening to traffic, the surface of the RBC shall be maintained in a condition suitable for the safe movement of traffic.

308.13 Maintenance

The Contractor shall maintain the RBC in a satisfactory manner until the surface course has been constructed.

Any damage to the completed recycled material shall be repaired by the Contractor prior to the placement of new asphalt concrete or final surface sealing. Patching shall be in accordance with 304. The excavated patch areas shall be filled and compacted with HMA or RBC material as directed by the Engineer. No direct payment will be made for damage or repair unless approved by the Engineer.

308.14 Curing

Before placing the final surfacing, the asphalt emulsion stabilized RBC shall remain in-place for a minimum of three days and meet one of the following conditions:

(a) there is less than 3.0% moisture remaining in the mixture, or

(b) the in-place moisture contents have remained constant at 50% or less of the design optimum moisture content for a continuous time period of five days.

The planned method and duration of curing for asphalt emulsion stabilized RBC shall be in accordance with the QCP. The specified surface course shall be placed within two weeks of the RBC final cure, but no later than November 1.

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308.15 Proofrolling

The asphalt emulsion stabilized RBC shall be proofrolled in accordance with 203.26 using a tandem or tri-axle dump truck loaded to the legal limit and operated between 2 to 4 mph over the RBC. The Engineer will determine the limits for any area that has deflection or rutting greater than 1/2 in.

The Contractor shall rework the areas failed in proofrolling by re-pulverizing and re-stabilizing the RBC in-place at no additional cost or by removing the RBC and stabilizing the subgrade with subgrade treatment Type IC in accordance with 207.

The reworked areas shall be proofrolled for final acceptance.

In locations of failing subgrade the RBC shall be removed and subgrade treatment Type IC shall be placed in accordance with 207. HMA patching, type B shall be placed in accordance with 304.

308.16 Milling

The entire surface of the asphalt emulsion stabilized RBC shall be scarified in accordance with 306 to the specified cross-slope in preparation for the overlay. Construction engineering in accordance with 105.08(b) shall be provided.

308.17 Underdrain Installation

Underdrain installation in accordance with 718, when required, shall begin after having completed the proofrolling.

308.18 RBC Overlay

The overlay atop the RBC shall be as shown on the plans. The overlay shall be placed after having completed the proofrolling.

The RBC shall be swept of all loose material and standing water with a rotary power broom in accordance with 409 immediately prior to placing the surface. The RBC shall be swept lightly to avoid damage to the RBC.

A tack coat shall be required only for the HMA overlay and shall be applied to the RBC in accordance with 406 immediately following sweeping operations.

Monuments shall be reestablished in accordance with 615.10.

308.19 Method of Measurement

The RBC will be measured by the square yard complete in place. Asphalt emulsion will be measured by the ton. Subgrade treatment will be measured in accordance with

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207.05. Corrective aggregate to adjust the RBC gradation will be measured by the ton of material used. HMA patching, type B will be measured in accordance with 304.06. Milling will be measured in accordance with 306.10. Re-established monuments will be measured in accordance with 615.13. Removal of snowplowable raised pavement markers will be measured in accordance with 808.12.

308.20 Basis of Payment

The RBC will be paid for as full depth reclamation at the contract unit price per square yard, complete in place. Asphalt emulsion will be paid for at the contract unit price per ton, complete in place. Subgrade treatment will be paid for in accordance with 207.06. Corrective aggregate used to adjust the RBC gradation will be paid for at the contract unit price per ton, complete in place. HMA patching, type B will be paid for in accordance with 304.07, of the thickness specified on the plans. Milling will be paid for in accordance with 306.11. Re-established monuments will be paid for in accordance with 615.14. Removal of snowplowable raised pavement markers will be paid for in accordance with 808.13.

Payment will be made under:

Pay Item	***Pay Unit Symbol***
Corrective Aggregate, FDR	*TON*
Full Depth Reclamation	*SYS*
Stabilizing Material, Asphalt Emulsion	*TON*
Stabilizing Material, Portland Cement	*TON*

The costs of the RBC mix design and QC testing shall be included in the cost of the full depth reclamation.

The costs associated with removal of grass and vegetation, rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be included in the cost of the full depth reclamation.

The costs associated with pulverizing, stabilizing, compacting, curing and maintenance of the RBC shall be included in the cost of the full depth reclamation.

The cost associated with mixing water shall be included in the cost of the full depth reclamation.

The cost associated with aggregate when used to supplement material volume shall be included in the cost of the ~~full depth reclamation~~corrective aggregate pay item.

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The cost associated with portland cement when used as an additive ~~shall be included in the cost of the full depth reclamation~~will be included in a change order for materials only and paid for as stabilizing material. The total cost will be equal to the invoice cost of the portland cement found to be appropriate for use.

The cost associated with aggregate when used to adjust the RBC gradation shall be included in the cost of the corrective aggregate pay item.

In the locations of failing subgrade, removal of the RBC shall be included in the cost of subgrade treatment.

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(Note: This RSP has been approved to be incorporated into 2020 Standard Specifications on September 20, 2018 SC meeting.
Proposed changes shown highlighted gray.)

416-R-638 COLD IN-PLACE RECYCLING, CIR

(Revised 09-20-18)

The Standard Specifications are revised as follows:

SECTION 416, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 416 - COLD IN-PLACE RECYCLING, CIR

416.01 Description

This work shall consist of milling and pulverizing a portion of the existing asphalt pavement to specified depth and maximum size, mixing asphalt emulsion, water and additives to produce a recycled asphalt layer. This material shall then be placed and compacted to the approved design properties in accordance with 105.03.

416.02 Just-in-Time Training, JITT

The Engineer and Contractor are required to attend a JITT course regarding CIR and both shall mutually agree on the course instructor, course content and training site. The training class shall be conducted at a project field location convenient for all project construction personnel responsible for CIR operations and inspection to attend.

The JITT course shall be held during normal working hours and be completed not more than 14 days prior to the start of CIR operations.

The Contractor shall provide a JITT instructor experienced in the construction methods, materials and test methods associated with asphalt emulsion stabilized CIR. A copy of the course syllabus, handouts and presentation materials shall be submitted to the Engineer at least five business days before the course is to be taught.

416.03 Quality Control

A quality control plan, QCP, shall be submitted to the Engineer a minimum of five calendar days prior to the JITT. The QCP shall include the proposed CIR mix design, a start to finish process description to include discussion on corrective action measures, a list of proposed equipment, a list of proposed QC tests and testing frequencies, and the curing methods applied to the CIR. All QC test results shall be maintained during the duration of the contract and made available to the Engineer upon request.

The following table provides the type and minimum frequency for tests.

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QC TESTING	
Test	*Frequency*[1,2]
Depth of Pulverization	*1 per 500 ft*
Pulverized Material Gradation	*1 per 0.5 day of processing*
Asphalt Emulsion Content	*1 per 500 ft*
Water Content	*1 per 500 ft*
Compacted In-Place Field Density	*1 per 1,000 ft*
Field Moisture Content for Curing	*1 per each day of production*

Notes:

1: The Contractor shall perform all QC tests within the first 500 ft after startup and after any change in the mix design.
2: Testing frequency is based upon linear feet of CIR processing.

MATERIALS

416.04 Materials

CIR shall consist of a homogenous blend of reclaimed asphalt pavement, RAP, combined with asphalt emulsion, water, and when required, recycling additives such as corrective aggregate or cement. Cement recycling additives used in asphalt emulsion stabilized CIR may be dry powder or slurry with a minimum dry solids content of 60%. The actual materials used are dependent on the CIR mix design and project requirements.

Materials for use in CIR shall be in accordance with the following:

Asphalt Emulsion .....902.01(b)3
Corrective aggregate to adjust gradation or supplement material volume:
1. Coarse or Dense Graded Aggregate, Class C or Higher 904.03
2. Fine Aggregate.....904.02
3. RAP shall be the product resulting from the cold milling or crushing of an existing asphalt pavement. The RAP coarse aggregate shall be processed so that 100% passes the 1 1/2 in. (37.5 mm) sieve.
Portland Cement, Type I.....901.01(b)
Water.....913.01

Acceptance of the RBC will be in accordance with the Frequency Manual on the basis of a type D certification in accordance with ITM 804.

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416.05 Mix Design

The CIR mix design shall be in accordance with ITM 592 and comprised of existing RAP, asphalt emulsion and if necessary, recycling additives. The mix design and all associated testing shall be performed, using samples of the existing pavement material from the project site representing the recycling depth, by a design laboratory that is AMRL accredited in HMA and asphalt emulsion. Additional mix designs shall be performed when the in-place material changes significantly in order to establish representative mixes for the entire job. The Contractor shall be responsible for obtaining all samples required to develop the mix design. One sample per lane mile of planned CIR shall be the minimum sampling frequency for mix design preparation.

The Contractor shall provide a mix design or designs for approval at least five calendar days prior to the JITT. The mix design shall include all test results performed. If new materials are added, a new mix design, including the updated test results, shall be submitted at least one day prior to implementation.

CONSTRUCTION REQUIREMENTS

416.06 Roadway Preparation

Snowplowable raised pavement markers shall be removed in accordance with 808.11(e) prior to CIR operations.

Grass and other vegetation shall be removed from the edge of the existing pavement to prevent contamination of the pulverized material during milling operation.

Grade adjustments of existing structures shall be made in accordance with 720.04 except existing structures shall be lowered prior to CIR operations, properly covered and filled with material compatible with the CIR mix design to maintain traffic prior to CIR operations.

All areas of soft or yielding subgrade, as shown on the plans, shall be corrected prior to CIR operations.

416.07 Equipment

The recycling equipment shall be capable of milling the existing asphalt pavement, sizing the resulting RAP and mixing the RAP with the materials stipulated in the mix design. The recycling equipment shall be capable of meeting the specified sizing requirement with either the milling process or with additional sizing equipment. The recycling equipment shall be capable of producing a homogenous and uniformly coated CIR mixture by mixing the RAP with the asphalt emulsion, water and any other additives, either in the cold planer housing or in an additional mixing chamber. The equipment used

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for placement of the CIR mixture shall be capable of the placement in accordance to 105.03.

The CIR equipment shall consist of the following major components.

(a) Cold In-Place Recycler Equipment

The cold in-place recycling equipment will include either a single unit recycler or a multi-unit recycler.

1. Single Unit Recycler

The single-unit recycler shall be a self-propelled cold milling machine/cold recycling machine with a down cutting cutter head capable of pulverizing and recycling the existing HMA pavement to the depth specified, incorporate the asphalt emulsion and water and mix the materials to produce a homogenous mixture. The machine shall have two systems for adding asphalt emulsion and water, with each system having a full width spray bar with a positive displacement pump interlocked to the machine's ground speed to insure that the amount of asphalt emulsion and water being added is automatically adjusted with changes to the machine's ground speed. Each additive system shall have its own spray bar equipped with two nozzles per foot of spray bar and be capable of incorporating up to 7 gal./sq yd of asphalt emulsion or water. Individual valves on the spray bar shall be capable of being turned off as necessary to minimize asphalt emulsion and water overlap on subsequent passes.

2. Multi-Unit Recycler

A multi-unit recycler may be utilized instead of a single unit recycler. The multi-unit train shall contain the following:

a. A self-propelled cold milling machine that is capable of pulverizing the existing asphalt material in a single pass to the depth shown on the plans and to a minimum width of not less than 12 1/2 ft. The machine shall have automatic depth controls to maintain the cutting depth to within ± 1/4 in. of that shown on the plans, and shall have a positive means for controlling cross slope elevations. The use of a heating device to soften the pavement will not be allowed.

b. A material sizing unit having screening and crushing capabilities to reduce the cold pulverized material to the appropriate size. The screening and crushing unit shall have a closed circuit system capable of continuously returning oversized material to the crusher. All of the pulverized material shall be processed to the maximum size requirements specified.

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c. A mixing unit equipped with a belt scale for the continuous weighing of the pulverized and sized asphalt material and a coupled/interlocked computer controlled liquid metering device. The mixing unit shall be an on-board completely self-contained pugmill. The liquid metering device shall deliver the amount of asphalt emulsion to within ± 0.25% of the required amount by weight of the pulverized asphalt material. The asphalt emulsion pump shall be sufficient capacity to allow emulsion contents up to 4.0% by weight of pulverized material. Also, automatic digital readings shall be displayed for both the flow rate and total amount of pulverized asphalt material and asphalt emulsion in appropriate units of weight and time.

(b) Spreaders for Dry Cement

Spreaders used to apply dry cement recycling additives shall be non-pressurized mechanical vane-feed, cyclone or screw type capable of providing a consistent, accurate and uniform distribution of material while minimizing dust during construction.

(c) Additive Slurry Storage and Supply Equipment

Slurry shall be produced using a batch or continuous-flow type stationary mixer equipped with calibrated metering and feeding devices that introduce the cement, water and additives into the mixer in the specified quantities. Additive slurry storage and supply equipment shall have agitators or similar equipment to keep the slurry in suspension when held in the slurry batch or storage tanks. Slurry shall be kept in suspension during transport using agitator equipment.

(d) Spreading of Corrective Aggregate

Corrective aggregate, when required shall be placed with a mechanical spreader or a conventional paver.

(e) Water Truck

A water truck for supplying water to the milling equipment during CIR operation shall be provided. The water truck system shall be able to supply the mixing chamber, if necessary, so as to provide an independent source of water to properly disperse the asphalt emulsion.

(f) Laydown Equipment

The processed CIR mixture shall be spread uniformly across the recycling width using either a self-propelled paver in accordance with 409.03(c) or screed integral to the recycling equipment.

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In either case, the screed shall be controlled by electronic grade and cross slope control. The equipment shall be of sufficient size and power to spread the recycled material in one continuous pass, without segregation, in accordance with 105.03. Heating of the screed shall not be allowed.

In utilizing a self-propelled paver, material shall either be loaded directly into the paver hopper from the recycling equipment or loaded by a pickup device from a windrow.

If utilizing a pickup device, it shall be capable of removing and transferring the entire windrow of recycled mix in a single pass. The pick-up machine shall be within 150 ft of the mixing unit throughout the treatment process.

(g) Compaction Equipment

Compaction equipment shall be in accordance with 409.03(d). The number, weight, and types of rollers shall be as necessary to obtain required compaction. At a minimum, the following rollers shall be used:

1. *At least one pneumatic tired roller in accordance with 409.03(d)3 with a minimum weight of not less than 20 tons.*

2. *At least one double drum vibratory roller in accordance with 409.03(d)4 with a minimum weight of not less than 10 tons.*

416.08 Weather Limitations

CIR operations shall be performed when the RAP temperature, or pavement surface temperature, is above 50ºF with ambient temperatures above 35ºF for seven days. The Engineer may restrict work when the heat index is greater than 100°F. The CIR shall not be performed before May 1 or after October 1.

416.09 Processing and Mixing Operation

For CIR mixtures, the pulverization shall produce a gradation that has 100% passing the 1 1/2 in. (37.5 mm) sieve.

Corrective aggregate, when required, shall be spread onto the existing surface using a mechanical spreader or a conventional paver.

An additive used in asphalt emulsion stabilized CIR may be dry powder or slurry and the Contractor shall address the application methods and fugitive dust control procedures in the QCP when dry powder materials are used.

The pulverized material shall be processed through a mixing unit capable of combining the pulverized material, asphalt emulsion, and any additives to produce a

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homogenous recycled mixture. The asphalt emulsion shall be injected into the pulverized asphalt material at the initial rate determined by the mix design and approved by the Engineer. Sampling and mix design may determine different levels of asphalt emulsion at various portions of the project.

When a paving fabric is encountered during the pulverization operation, the Contractor shall make the necessary changes in equipment or operations so that incorporation of shredded fabric into the CIR does not affect the performance parameters or inhibit placement or compaction of the CIR. The Contractor shall be required to remove and properly dispose of oversized pieces of paving fabric. The Contractor shall make the necessary adjustments in equipment or operations so that the shredded fabric in the recycled material is no more than 5 sq in. No fabric piece shall have a dimension exceeding a length of 4 in.

Rubberized crack filler, durable pavement markings, loop wires, and other non-pavement materials shall be removed as observed from the roadway during the CIR process. Residual materials that cannot be completely removed may be incorporated into the mixture if the Contractor can demonstrate that those added materials will not adversely affect performance.

Any such materials retained in the mixture shall be appropriately sized and blended so as to not adversely affect the strength of the CIR.

Asphalt emulsion shall have an application tolerance determined by adding ± 0.25% to the percent total asphalt emulsion content recommended by the mix design.

The Contractor can request the asphalt emulsion percentage to exceed the upper tolerance provided the mix design requirements are satisfied at the requested percentage. The request will be subject to approval by the Engineer.

416.10 Control Strip and Compaction

A minimum 500 ft long control strip shall be conducted on the first day of production to verify the construction process meets the requirements as specified. The control strip shall allow the Contractor to:

(a) Demonstrate the proposed equipment, materials and processes can produce a CIR layer in accordance with specification requirements.

(b) Determine the optimal rates for the asphalt emulsion, water and any additives recommended for the reclaimed material.

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(c) Determine the sequence and manner of rolling necessary to obtain specified density requirements.

The CIR density shall be achieved with the same equipment, materials, construction methods and density requirements used on the accepted control strip. A new control strip shall be constructed if changes are made outside of the tolerances of the original mix design, equipment or construction methods.

A rolling pattern that produces the maximum obtainable density, or optimum field density, shall be determined during the control strip. The Contractor shall provide a sequence and manner of rolling by establishing a roller pass versus density chart that shows the progress of densification from initial lay down through optimum field density using a properly calibrated nuclear gauge in accordance to AASHTO T 310. Production may continue after approval of the control strip.

The Contractor shall perform compaction testing in accordance with AASHTO T 310 during production to ensure compaction is between 97% and 102% of the optimum field density established during the control strip. If two successive tests indicate compaction is over 102% or below 97% of the optimum field density, a new rolling pattern and roller pass versus density chart shall be established.

The QC technician shall be on site, observing all compaction efforts and approving areas as they reach minimum relative compaction. Care shall be taken not to over compact the mat.

Any type of rolling effort that causes cracking, displacement or other type of pavement distress shall be discontinued until such time as the problem can be resolved and approved by the Engineer.

Rollers shall not be started or stopped on recycled material except when changing direction during the compaction process.

All tests shall be conducted at the stated QC testing frequencies throughout CIR operations.

416.11 Opening to Traffic

Opening to traffic shall occur after sufficient cure time has been applied to the CIR so traffic will not initiate raveling or permanent deformation. All loose particles that may develop on the pavement surface shall be removed by a rotary power broom in accordance with 409.

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After opening to traffic, the surface of the recycled pavement shall be maintained in a condition suitable for the safe movement of traffic.

416.12 Maintenance

The Contractor shall maintain the recycled pavement in a manner satisfactory to the Engineer until the surface course has been constructed.

Any damage to the completed recycled material shall be repaired by the Contractor prior to the placement of new asphalt concrete or final surface sealing. Patching shall be in accordance with 304. The excavated patch areas shall be filled and compacted with HMA or CIR material as directed by the Engineer. No direct payment will be made for damage or repair unless approved by the Engineer.

416.13 Curing

Before placing the final surfacing, the recycled surface shall remain in-place for a minimum of three days and meet one of the following conditions:

(a) there is less than 3.0% moisture remaining in the mixture, or

(b) The material has remained in-place for a minimum of 10 days without rainfall.

The planned method and duration of curing for CIR shall be in accordance with the QCP. The specified surface course shall be placed within two weeks of the CIR final cure, but no later than November 1.

416.14 Milling

The entire surface of the CIR shall be scarified in accordance with 306 to the specified cross-slope in preparation for the overlay. Construction engineering in accordance with 105.08(b) shall be provided.

416.15 CIR Surface Course

The surface course atop the CIR shall be as shown on the plans.

The CIR shall be swept of all loose material and standing water with a rotary power broom in accordance with 409 immediately prior to placing the surface. The CIR shall be swept lightly to avoid damage to the CIR.

A tack coat shall be required only for the HMA overlay and shall be applied to the CIR in accordance with 406 immediately following sweeping operations.

Monuments shall be reestablished in accordance with 615.10

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416.16 Method of Measurement

The CIR will be measured by the square yard, complete in place. Asphalt emulsion will be measured by the ton. Aggregate to adjust the CIR gradation will be measured by the ton of material used. HMA Patching will be measured in accordance with 304.06. Milling will be measured in accordance with 306.10. Re-established monuments will be measured in accordance with 615.13. Grade adjustment of existing structures will be measured in accordance with 720.06. Removal of snowplowable raised pavement markers will be measured in accordance with 808.12.

416.17 Basis of Payment

The CIR will be paid for at the contract unit price per square yard, complete in place. Asphalt emulsion will be paid for at the contract unit price per ton, complete in place. Aggregate used to adjust the CIR gradation will be paid for at the contract unit price per ton, complete in place. HMA patching will be paid for in accordance with 304.07, of the thickness specified on the plans. Milling will be paid for in accordance with 306. 11. Re-established monuments will be paid for in accordance with 615.14. Grade adjustment of existing structures will be paid for in accordance with 720.07. Removal of snowplowable raised pavement markers will be paid for in accordance with 808.13.

Payment will be made under:

Pay Item	***Pay Unit Symbol***
Cold In-Place Recycling	*SYS*
Corrective Aggregate, CIR	*TON*
Stabilizing Material, Asphalt Emulsion	*TON*
Stabilizing Material, Portland Cement	*TON*

The costs of the CIR mix design and QC testing shall be included in the cost of the CIR.

The costs associated with removal of grass and vegetation, rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be included in the cost of the CIR.

The costs associated with stabilizing, compacting, curing and maintenance of the CIR not related to failing subgrade shall be included in the cost of the CIR.

The cost associated with mixing water shall be included in the cost of the CIR.

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The cost associated with aggregate when used to supplement material volume shall be included in the cost of the ~~CIR~~corrective aggregate pay item.

The cost associated with portland cement when used as an additive ~~shall be included in the cost of the CIR~~will be included in a change order for materials only and paid for as stabilizing material. The total cost will be equal to the invoice cost of the portland cement found to be appropriate for use.

The cost associated with aggregate when used to adjust the CIR gradation shall be included in the cost of the corrective aggregate pay item.

The cost of milling the asphalt emulsion stabilized CIR to maintain profile shall be included in the cost of the milling.

In the locations of failing subgrade, removal of the CIR shall be included in the cost of subgrade treatment.

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(Note: This RSP approved to be incorporated into 2020 Standard Specifications on September 20, 2018 SC meeting. Proposed changes shown highlighted gray.)

417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

(Revised 09-20-18)

The Standard Specifications are revised as follows:

SECTION 417, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 417 - COLD CENTRAL PLANT RECYCLING, CCPR

417.01 Description

This work shall consist of a mixture of sized Reclaimed Asphalt Pavement, RAP, millings from existing asphalt pavement or existing stockpiles, asphalt emulsion, water and other additives. The mixture shall be produced at a nearby location, then placed and compacted to produce a recycled asphalt layer to the approved design properties in accordance with 105.03.

417.02 Just-in-Time Training, JITT

The Engineer and Contractor are required to attend a just-in-time training, JITT, course regarding CCPR and both shall mutually agree on the course instructor, course content and training site. The training class shall be conducted at a project field location convenient for all project construction personnel responsible for CCPR operations and inspection to attend.

The JITT course shall be held during normal working hours and be completed not more than 14 days prior to the start of CCPR operations.

The Contractor shall provide a JITT instructor experienced in the construction methods, materials and test methods associated with asphalt emulsion stabilized CCPR. A copy of the course syllabus, handouts and presentation materials shall be submitted to the Engineer at least five business days before the course is to be taught.

417.03 Quality Control

A quality control plan, QCP, shall be submitted to the Engineer a minimum of five calendar days prior to the JITT. The QCP shall include the proposed CCPR mix design, a start to finish process description to include discussion on corrective action measures, a list of proposed equipment, a list of proposed QC tests and testing frequencies, and the curing methods and procedures applied to the CCPR. All QC test results shall be

maintained during the duration of the contract and made available to the Engineer upon request.

The following table provides the type and minimum frequency for tests:

QC TESTING	
Test	*Frequency[1,2]*
Depth of Laydown	*1 per 500 ft*
Pulverized Material Gradation	*1 per 1,000 tons of production*
Pulverized Material Moisture Content	*1 per 500 tons of production*
Asphalt Emulsion Content[3]	*1 per 500 tons of production*
Water Content[3]	*1 per 500 tons of production*
Compacted In-Place Field Density	*1 per 1,000 ft*
Field Moisture Content for Curing	*1 per each day of production*
Note 1: The Contractor shall perform all quality control tests within the first 500 ft after startup and after any change in the mix design. *Note 2: Testing frequency is based upon either linear foot of CCPR laydown or tons of CCPR mixture processing.* *Note 3: Asphalt emulsion content and water content shall be taken from the readings of the control settings of the mixing unit.*	

MATERIALS

417.04 Materials

CCPR shall consist of a homogenous blend of RAP combined with asphalt emulsion, water, and when required, recycling additives such as corrective aggregate or cement. Cement recycling additives used in asphalt emulsion stabilized CCPR may be dry powder or slurry with a minimum dry solids content of 60%. The actual materials used are dependent on the CCPR mix design and project requirements.

Materials for use in CCPR shall be in accordance with the following:

Asphalt Emulsion .....902.01(b)3
Corrective Aggregate to adjust gradation or supplement material volume:
1. *Coarse or Dense Graded Aggregate, Class C or Higher ... 904.03*
2. *Fine Aggregate.....904.02*
3. *RAP shall be the product resulting from the cold milling or crushing of existing asphalt pavement and processed so that 100% passes the 1 ~~1/4~~1/2 in. (~~31.5~~37.5 mm) sieve.*

Portland Cement, Type I.....901.01(b)
Water.....913.01

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Acceptance of the RBC will be in accordance with the Frequency Manual on the basis of a type D certification in accordance with ITM 804.

417.05 Mix Design

CCPR mix designs shall be in accordance with ITM 592 and comprised of existing RAP, asphalt emulsion and recycling additives, if necessary. The mix design and all associated testing shall be performed using samples of each proposed material. RAP samples shall either be collected from the existing pavement at the project site representing the milling depth or from the RAP stockpile to be used during construction. The mix design shall be completed by a design laboratory that is AMRL accredited in HMA and asphalt emulsion. Additional mix designs shall be performed when the proposed material changes significantly in order to establish representative mixes for the entire job. The Contractor shall be responsible for obtaining all samples required to develop the mix design. One sample per lane mile of planned CCPR shall be the minimum sampling frequency for mix design preparation.

The Contractor shall provide a mix design or designs for approval at least five calendar days prior to the JITT. The mix design shall include all test results performed. If new materials are added, a new mix design, including the updated test results, shall be submitted at least one day prior to implementation.

CONSTRUCTION REQUIREMENTS

417.06 Roadway Preparation

Snowplowable raised pavement markers shall be removed in accordance with 808.11(e) prior to CCPR operations.

Grass and other vegetation shall be removed from the edge of the existing pavement to prevent contamination of the pulverized asphalt material during milling operation.

All areas of soft or yielding subgrade shall be corrected prior to CCPR operations.

If the CCPR mix is to be placed on a prepared subgrade or aggregate base, ensure the subgrade soils and base have been properly prepared, moisture treated and compacted to the minimum density according to plans or specifications, immediately prior to placement of the CCPR mix, so as to create an evenly graded, unyielding surface.

417.07 Pavement Removal

The existing asphalt pavement shall be milled in accordance with 306 to the length, depth and width as shown on the plans or specifications. The RAP shall be free of contamination of dirt, base, concrete or other deleterious materials such as silt and clay.

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When a paving fabric is encountered during the pulverization operation, the Contractor shall make the necessary changes in equipment or operations so that incorporation of shredded fabric into the CCPR does not affect the performance parameters or inhibit placement or compaction of the CCPR. The Contractor shall be required to remove and properly dispose of oversized pieces of paving fabric. The Contractor shall make the necessary adjustments in equipment or operations so that the shredded fabric in the recycled material is no more than 5 sq in. No fabric piece shall have a dimension exceeding a length of 4 in.

Rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be removed as observed from the roadway. Residual materials that cannot be completely removed may be incorporated into the mixture if the Contractor can demonstrate that those added materials will not adversely affect performance.

Any such materials retained in the mix shall be appropriately sized and blended so as not to adversely affect the strength of the recycled pavement.

417.08 Equipment

The equipment shall consist of the following major components:

(a) Milling Machine/Pavement Cold Planer

Milling equipment shall be in accordance with 306.03(a). The equipment shall be capable of pulverizing the existing asphalt material in a single pass to the depth shown on the plans. The machine shall have automatic depth controls to maintain the cutting depth to within ± 1/4 in. of that shown on the plans. The milling operation shall not disturb or damage the underlying material. The use of a heating device to soften the pavement will not be allowed.

(b) Additive Slurry Storage and Supply Equipment

Slurry shall be produced using a batch or continuous-flow type stationary mixer equipped with calibrated metering and feeding devices that introduce the cement, water and additives into the mixer in the specified quantities. Additive slurry storage and supply equipment shall have agitators or similar equipment to keep the slurry in suspension when held in the slurry batch or storage tanks. Slurry shall be kept in suspension during transport using agitator equipment.

(c) Sizing Equipment

A material sizing unit shall be capable of sizing using a scalping screen or crushing capabilities to reduce RAP to a maximum size of 1 ~~1/4~~1/2 in. (~~31.5~~37.5 mm) or to the maximum size requirements specified prior to mixing with the asphalt emulsion.

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(d) Mixing and Proportioning Equipment

The equipment shall be capable of processing sized RAP, asphalt emulsion, water and any additives stipulated in the mix design to a homogenous and uniformly coated CCPR mixture. The equipment shall be in accordance with 409.02(b) and display automatic digital readings shall be displayed for flow rate of both the RAP and asphalt emulsion in appropriate units of weight and time.

The mixing apparatus shall have cold feed hopper equipped with vibrators on the hopper's walls to assist the free flow of materials to a variable speed belt conveyor. Control of the RAP shall be by mechanically adjustable gate valves at the point of discharge or a RAP belt scale for the continuous weighing of the RAP. The variable speed belt conveyor or RAP belt scale shall be interlocked to the asphalt emulsion metering device.

The asphalt emulsion metering device shall be capable of automatically adjusting the flow of asphalt emulsion to compensate for any variation in the amount of RAP introduced into the mixing apparatus. Asphalt emulsion shall be metered by weight of RAP using a calibrated meter that will accurately measure the amount of asphalt emulsion to within a tolerance of ± 2.0% of the specified rate.

(e) Hauling Equipment

Hauling equipment shall be in accordance with 409.03(b).

(f) Laydown Equipment

Laydown equipment shall be in accordance with 409.03(c).

The paver screed shall be controlled by electronic grade and cross-slope control. Heating of the screed shall not be allowed.

CCPR material shall either be loaded directly into the paver hopper from transport trucks or loaded by a pickup device. If utilizing a pickup device, it shall be capable of removing and transferring the entire windrow of recycled mix in a single pass.

The equipment used for placement of the CCPR mixture shall be capable of the placement in accordance to 105.03.

(g) Compaction Equipment

Compaction equipment shall be in accordance with 409.03(d). The number, weight, and types of rollers shall be as necessary to obtain required compaction. At a minimum, the following rollers shall be used:

1. At least one pneumatic tired roller in accordance with 409.03(d)3 with a minimum weight of not less than 20 t.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
308-R-656 ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR
416-R-638 COLD IN-PLACE RECYCLING, CIR
417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

2. At least one double drum vibratory roller in accordance with 409.03(d)4 with a minimum weight of not less than 10 t.

417.09 Weather Limitations

CCPR operations shall be performed when the RAP temperature, or pavement surface temperature, is above 50ºF with ambient temperatures above 35ºF for seven days. The Engineer may restrict work when the heat index is greater than 100°F. The CCPR shall not be performed before May 1 or after October 1.

417.10 Material Sizing and Stockpiling

The gradation of the RAP shall have 100% passing the 1 ~~1/~~41/2 in. (~~31.5~~37.5 mm) sieve, or be sized to meet specific contract requirements.

RAP that has been crushed and screened shall be stockpiled and maintained to prevent reconsolidation. Water may be added to RAP as it is screened and crushed to abate dust and mitigate reconsolidation.

Corrective aggregate, if required, shall either be mixed with RAP to create a homogenous mixture during stockpiling or fed into the mixing apparatus at the rate determined by the mix design.

417.11 Processing and Mixing Operation

The sized RAP shall be processed through a mixing unit capable of combining the sized RAP, asphalt emulsion, and any additives to produce a homogenous recycled mixture.

An additive used in asphalt emulsion stabilized CCPR may be dry powder or slurry and the Contractor shall address the application methods and fugitive dust control procedures in the QCP when dry powder materials are used.

The asphalt emulsion shall be injected into the CCPR materials at the initial rate determined by the mix design and approved by the Engineer. Sampling and mix design may determine different levels of asphalt emulsion at various portions of the project.

The asphalt emulsion shall have an application tolerance determined by adding ± 0.25% to the percent total asphalt emulsion content.

The Contractor can request the asphalt emulsion percentage to exceed the upper tolerance provided the mix design requirements are satisfied at the requested percentage. The request will be subject to approval by the Engineer.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
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417.12 Placement

The depth of CCPR shall be as indicated on the plans.

The hauling equipment shall deliver the blended CCPR material into the paver within one hour of mixing or before the asphalt emulsion begins to break and set.

CCPR single lift thickness shall be a minimum compacted depth of 3 in. and not exceed a maximum compacted depth of ~~65~~ in. A minimum lift thickness of 2 in. can be utilized if the crushed RAP has a maximum size of 1 in. When the CCPR material is placed in two lifts, tack coat in accordance with 406 shall be applied between the lifts.

417.13 Control Strip and Compaction

A minimum 500 ft long control strip shall be conducted on the first day of production to verify the construction process meets the requirements as specified. The control strip shall allow the Contractor to:

(a) demonstrate the equipment, materials and processes proposed to produce a CCPR layer in accordance with specification requirements, and;

(b) determine the optimal rates for the asphalt emulsion, water and any additives recommended for the material, and;

(c) determine the sequence and manner of rolling necessary to obtain specified density requirements in one uniformly compacted layer.

The CCPR density shall be achieved with the same equipment, materials, construction methods and density requirements used on the accepted control strip. A new control strip shall be constructed if changes are made outside of the tolerances of the original mix design, equipment or construction methods.

A rolling pattern that produces the maximum obtainable density, or optimum field density, shall be determined during the control strip. The Contractor shall provide a sequence and manner of rolling by establishing a roller pass versus density chart that shows the progress of densification from initial lay down through optimum field density using a properly calibrated nuclear gauge in accordance to AASHTO T 310. Production may continue after approval of the control strip.

The Contractor shall perform compaction testing in accordance with AASHTO T 310 during production to ensure compaction is between 97% and 102% of the optimum field density established during the control strip. If two successive tests indicate compaction is over 102% or below 97% of the optimum field density, a new rolling pattern and roller pass versus density chart shall be established.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
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The QC technician shall be on site, observing all compaction efforts and approving areas as they reach minimum relative compaction. Care shall be taken not to over compact the mat.

Any type of rolling effort that causes cracking, displacement or other type of pavement distress shall be discontinued until such time as the problem can be resolved and approved by the Engineer.

Rollers shall not be started or stopped on recycled material unless when changing direction during the compaction process.

All tests shall be conducted at the stated QC testing frequencies throughout CCPR operations.

417.14 Opening to Traffic

Opening to traffic shall occur after sufficient cure time has been applied to the CCPR so traffic will not initiate raveling or permanent deformation. All loose particles that may develop on the pavement surface shall be removed by a rotary power broom in accordance with 409.

After opening to traffic, the surface of the recycled pavement shall be maintained in a condition suitable for the safe movement of traffic.

417.15 Maintenance

The Contractor shall maintain the recycled pavement in a manner satisfactory to the Engineer until the surface course has been constructed.

Any damage to the completed recycled material shall be repaired by the Contractor prior to the placement of new asphalt concrete or final surface sealing. Patching shall be in accordance with 304. The excavated patch areas shall be filled and compacted with HMA or CCPR material as directed by the Engineer. No direct payment will be made for damage repair unless approved by the Engineer.

417.16 Curing

Before placing the final surfacing, the recycled surface shall remain in-place for a minimum of three days and meet one of the following conditions:

(a) There is less than 3.0% moisture remaining in the mixture, or;

(b) The material has remained in-place for a minimum of 10 days without rainfall.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
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The planned method and duration of curing for CCPR shall be in accordance with the QCP. The specified surface course shall be placed within two weeks of the CCPR final cure, but no later than November 1.

417.17 Milling and Pavement Smoothness

When the CCPR material is placed in a single lift, the entire surface of the CCPR shall be scarified in accordance with 306 to the specified cross-slope in preparation for the overlay. Construction engineering in accordance with 105.08(b) shall be provided.

Pavement smoothness of the cured CCPR mat shall meet the requirements of 401.18(b) The Contractor shall correct humps or depressions exceeding the tolerances in accordance with 401.18(c).

417.18 CCPR Surface Course

The CCPR shall be swept of all loose material and standing water with a rotary power broom in accordance with 409 immediately prior to placing the tack coat. A tack coat shall be required and shall be applied to the CCPR in accordance with 406.

Monuments shall be reestablished in accordance with 615.10 after the surface course is placed.

417.19 Method of Measurement

The CCPR will be measured by the square yard, complete in place. Asphalt emulsion will be measured by the ton. Aggregate to adjust the CCPR gradation will be measured by the ton of material used. HMA Patching will be measured in accordance with 304.06. Re-established monuments will be measured in accordance with 615.13. Grade adjustment of existing structures will be measured in accordance with 720.06. Removal of snowplowable raised pavement markers will be measured in accordance with 808.12.

417.20 Basis of Payment

The CCPR will be paid for at the contract unit price per square yard, complete in place. Asphalt emulsion will be paid for at the contract unit price per ton, complete in place. Aggregate used to adjust the CCPR gradation will be paid for at the contract unit price per ton, complete in place. HMA patching will be paid for in accordance with 304.07, of the thickness specified on the plans. Re-established monuments will be paid for in accordance with 615.14. Grade adjustment of existing structures will be paid for in accordance with 720.07. Removal of snowplowable raised pavement markers will be paid for in accordance with 808.13.

Payment will be made under:

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
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Pay Item	***Pay Unit Symbol***
Cold Central Plant Recycling	*SYS*
Corrective Aggregate, CCPR	*TON*
Stabilizing Material, Asphalt Emulsion	*TON*
Stabilizing Material, Portland Cement	*TON*

The costs associated with the CCPR mix design and quality control testing shall be included in the cost of the cold central plant recycling.

The costs associated with the removal of grass and vegetation, rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be included in the cost of the cold central plant recycling.

The costs associated with pulverizing, stabilizing, compacting, curing and maintenance of the CCPR not related to failing subgrade shall be included in the cost of the cold central plant recycling.

The cost associated with mixing water for cold central plant material shall be included in the cost of the cold central plant recycling.

The cost associated with aggregate when used to supplement material volume shall be included in the cost of the ~~cold central plant recycling~~corrective aggregate pay item.

The cost associated with the use of portland cement when used as an additive~~ shall be included in the cost of the cold central plant recycling~~will be included in a change order for materials only and paid for as stabilizing material. The total cost will be equal to the invoice cost of the portland cement found to be appropriate for use.

The cost associated with aggregate when used to adjust the CCPR gradation shall be included in the cost of the corrective aggregate pay item.

The costs of the asphalt emulsion stabilizing material shall be included in the cost of the stabilizing material pay item.

In the locations of failing subgrade, removal of the CCPR shall be included in the cost of subgrade treatment.

COMMENTS AND ACTION

307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR
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416-R-638 COLD IN-PLACE RECYCLING, CIR
417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

DISCUSSION:

Motion: Second: Ayes: Nays: FHWA Approval:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections referenced and/or affected: NONE Recurring Special Provision affected: 307-R-657 CEMENT STABILIZED FULL DEPTH RECLAMATION, FDR 308-R-656 ASPHALT EMULSION STABILIZED FULL DEPTH RECLAMATION, FDR 416-R-638 COLD IN-PLACE RECYCLING, CIR 417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR Standard Drawing affected: NONE Design Manual Sections affected: NONE GIFE Sections cross-references: NONE	_____ 2020 Standard Specifications _____ Revise Pay Items List _____ Create RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Revise RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Standard Drawing Effective _____ Create RPD (No. _____) Effective _____ Letting _____ GIFE Update _____ SiteManager Update

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Some fixed temporary signals have been equipped with used signal controllers from manufacturers that are not on INDOT's approved materials list, which has limited INDOT's ability to provide signal timing support. Also, for portable signals, the preferred vehicle detection method is Microwave or Doppler as these detection methods are less expensive and don't involve cutting loops or cores into the pavement.

Additionally, using two drums to delineate the portable signal trailer is insufficient if no other channelizing devices are present. Movable trailers are not tested to NCHRP Report 350 or MASH criteria.

PROPOSED SOLUTION: Revise §801.15(d) to: [1] require used signal controllers at temporary signals to be selected from a manufacturer on INDOT's approved materials list, [2] change the default detection method for portable signals to Microwave or Doppler, and [3] require a minimum of 3 drums to delineate the trailer of a portable signal.

APPLICABLE STANDARD SPECIFICATIONS: 801.15(d)

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: 83-5.02

APPLICABLE SECTION OF GIFE: N/A

APPLICABLE RECURRING SPECIAL PROVISIONS: N/A

PAY ITEMS AFFECTED: N/A

APPLICABLE SUB-COMMITTEE ENDORSEMENT: Yes, Traffic Standards Subcommittee.

IMPACT ANALYSIS (attach report): Yes

Submitted By: Joe Bruno on behalf of Dave Boruff

Title: Sr. Engineer of Signals & Markings

Organization: INDOT

Phone Number: (317) 234-7949

Date: 12/26/2018

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS

IMPACT ANALYSIS REPORT CHECKLIST

Explain the business case as to why this item should be presented to the Standards Committee for approval. Answer the following questions with Yes, No or N/A.

Does this item appear in any other specification sections? No

Will approval of this item affect the Approved Materials List? Yes, ITM 956 (a change has been proposed to the ITM Committee).

Will this proposal improve:

- Construction costs? Yes
- Construction time? Yes
- Customer satisfaction? Yes
- Congestion/travel time? Yes
- Ride quality? N/A

Will this proposal reduce operational costs or maintenance effort? N/A

Will this item improve safety:

- For motorists? Yes
- For construction workers? Yes

Will this proposal improve quality for:

- Construction procedures/processes? Yes
- Asset preservation? Yes
- Design process? N/A

Will this change provide the contractor more flexibility? No

Will this proposal provide clarification for the Contractor and field personnel? Yes

Can this item improve/reduce the number of potential change orders? Yes

Is this proposal needed for compliance with:

- Federal or State regulations? No
- AASHTO or other design code? No

Is this item editorial? No

Provide any further information as to why this proposal should be placed on the Standards Committee meeting Agenda: N/A

REVISION TO STANDARD SPECIFICATIONS

SECTION 801 - TRAFFIC CONTROL DEVICES AND LIGHTING
801.15(d)1 FIXED TEMPORARY SIGNALS
801.15(d)2 PORTABLE SIGNALS

The Standard Specifications are revised as follows:

SECTION 801, BEGIN LINE 775, DELETE AND INSERT AS FOLLOWS:

1. Fixed Temporary Signals

Fixed temporary signals shall be displayed overhead on a span, catenary, and tether utilizing an aircraft cable, unless otherwise directed.

Electric energy necessary to power the fixed temporary signal is the responsibility of the Contractor. Prior to the start of construction, the schedule of activities shall be coordinated with the power company.

The Contractor shall obtain permits from local officials, companies, or individuals for the use of poles, right-of-way, or other property incidental to the installation of fixed temporary signals. Although entering into the contract implies permission and authority to install conduit under pavement, sidewalks, and alleys, all damage to underground utilities or interruption of such service shall be the responsibility of the Contractor.

The location, spacing, and timing of fixed temporary signals will be determined by the Engineer.

An IMSA certified level II Traffic Signal Construction Technician or a level II Traffic Signal Field Technician shall be available 24 h a day to respond within 2 h for the maintenance of the traffic signal equipment.

The controller shall be traffic actuated solid state digital.

Vehicle detection shall be provided and shall be either inductive loop or wireless unless otherwise noted on the plans.

The controller shall be traffic actuated solid state digital. *For used controllers, the model selected shall be from a manufacturer with a controller on the Department's list of approved Traffic Signal and ITS Control Equipment.*

SECTION 801, BEGIN LINE 802, DELETE AND INSERT AS FOLLOWS:

2. Portable Signals

Portable signals shall be selected from the Department's list of approved Portable Signals. Prior to the activation, the Contractor shall provide a completed inspection checklist to the Engineer certifying that the portable signal is functioning properly.

The portable signal shall be equipped with remote monitoring. Unless otherwise shown on the plans, *Microwave or Doppler* ~~wireless~~ vehicle detection *as shown on the Department's list of approved Portable Signals* shall be provided. ~~Drums~~*A minimum of*

REVISION TO STANDARD SPECIFICATIONS

SECTION 801 - TRAFFIC CONTROL DEVICES AND LIGHTING
801.15(d)1 FIXED TEMPORARY SIGNALS
801.15(d)2 PORTABLE SIGNALS

three drums shall be placed immediately in front of the portable signal trailer ~~at both corners~~ for delineation.

BACKUP 1

REVISION TO IDM 83-5.02 APPLICATION (PROPOSED DRAFT)

(Note: Proposed changes shown highlighted gray)
[EXCERPT]

[---]

3. Type of Temporary Signal – One Lane, Two-Way Traffic Control. A temporary traffic signal may either be fixed or portable, the type selected should be detailed on the plans and the appropriate pay item included in the cost estimate.

   a. If a temporary traffic signal is chosen as an element of a temporary traffic control plan the designer should consider whether it may be more cost effective to use a portable signal. Portable signals are mounted on trailers rather than wood poles and are generally rented by the contractor. When the need for a temporary traffic signal is expected to be less than three months, or the cost to bring electric service to the location is more than $5,000, portable traffic signals will typically be less expensive. Portable signals require a relatively flat area, approximately 8 ft by 8 ft in size, to accommodate the trailer. If necessary, a temporary landing area for the trailer may be constructed, using suitable material, on the side slope. If a temporary landing area is needed it should be shown on the plans.

   b. In order to include the portable signal pay item into a contract the designer must obtain concurrence from the district Traffic Office that the portable type is the best option. The Temporary Traffic Signal Type Determination form is available from the Department's Editable Documents webpage, under Traffic Maintenance. The form should be submitted to the district Traffic Engineer as early as possible in the plan development process but at least prior to Stage 1 plan submittal.

4. Type of Temporary Signal - Intersection Traffic Control. In accordance with the *IMUTCD*, Section 4D.32 temporary signals for intersection traffic control must be fixed. However, roads and drives within a one lane, two-way work zone may be controlled by portable signals.

5. Vehicle Detection. Whether fixed temporary or portable, the signal should include vehicle detection. For fixed temporary signals, the detection area should be shown on the plans. See Figure 83-5A, Typical Detection Areas for Fixed Temporary Signals. The *Standard Specifications* allow the contractor to use either inductive loop or wireless detection for fixed temporary signals, and Microwave or Doppler for portable. Where it is determined that another type of detection is needed, a unique special provision should be included in the contract.

BACKUP 1

REVISION TO IDM 83-5.02 APPLICATION (PROPOSED DRAFT)

6. Phasing/Timing Plans for Portable Signals. If portable signals will be used, the designer should develop the signal phasing and timing plan in accordance with the FHWA *Signal Timing Manual* and complete the Temporary Signal Timing Plan (RSP 801-T-212) and include this in the contract documents.

COMMENTS AND ACTION

801.15(d)1 FIXED TEMPORARY SIGNALS
801.15(d)2 PORTABLE SIGNALS

DISCUSSION:

Motion: Second: Ayes: Nays: FHWA Approval:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections referenced and/or affected: 801.15 pg 768. Recurring Special Provision affected: NONE Standard Drawing affected: NONE Design Manual Sections affected: 83-5.02 GIFE Sections cross-references: NONE	_____ 2020 Standard Specifications _____ Revise Pay Items List _____ Create RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Revise RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Standard Drawing Effective _____ Create RPD (No. _____) Effective _____ Letting _____ GIFE Update _____ SiteManager Update

Mr. Orton
Date: 1/17/19

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD DRAWINGS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Pavement Sections for Public Road Approaches Standard Drawings require updating.

PROPOSED SOLUTION: Incorporate current recommended pavement sections for all Public Road Approaches, update series to improve consistency and clarity.

APPLICABLE STANDARD SPECIFICATIONS:

APPLICABLE STANDARD DRAWINGS: 610-PRAP series

APPLICABLE DESIGN MANUAL SECTION: 46-1.05(02) and 46-1.05(03) (no revisions required)

APPLICABLE SECTION OF GIFE:

APPLICABLE RECURRING SPECIAL PROVISIONS:

PAY ITEMS AFFECTED:

APPLICABLE SUB-COMMITTEE ENDORSEMENT: none

IMPACT ANALYSIS (attach report):

Submitted By: Mark Orton

Title: Standards Engineer, Office of Standards and Policy

Organization: Bridge Design Division

Phone Number: 317-233-3840

Date: 12/26/18

Mr. Orton
Date: 1/17/19

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD DRAWINGS

IMPACT ANALYSIS REPORT CHECKLIST

Explain the business case as to why this item should be presented to the Standards Committee for approval. Answer the following questions with Yes, No or N/A.

Does this item appear in any other specification sections? no

Will approval of this item affect the Approved Materials List? no

Will this proposal improve:

- Construction costs? no
- Construction time? no
- Customer satisfaction? no
- Congestion/travel time? no
- Ride quality? no

Will this proposal reduce operational costs or maintenance effort? no

Will this item improve safety:

- For motorists? no
- For construction workers? no

Will this proposal improve quality for:

- Construction procedures/processes? no
- Asset preservation? no
- Design process? no

Will this change provide the contractor more flexibility? no

Will this proposal provide clarification for the Contractor and field personnel? yes

Can this item improve/reduce the number of potential change orders? yes

Is this proposal needed for compliance with:

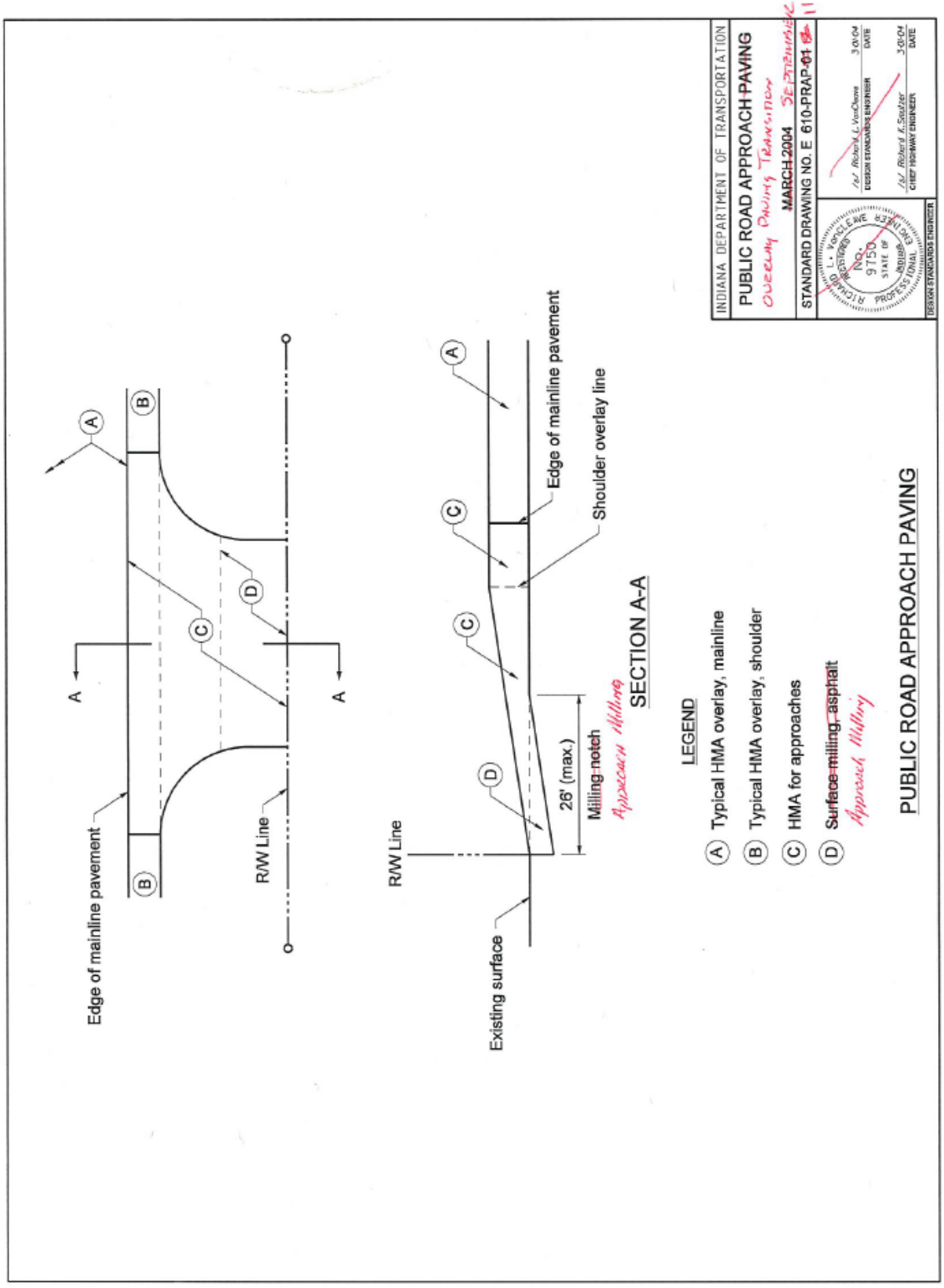
- Federal or State regulations? no
- AASHTO or other design code? no

Is this item editorial? no

Provide any further information as to why this proposal should be placed on the Standards Committee meeting Agenda:

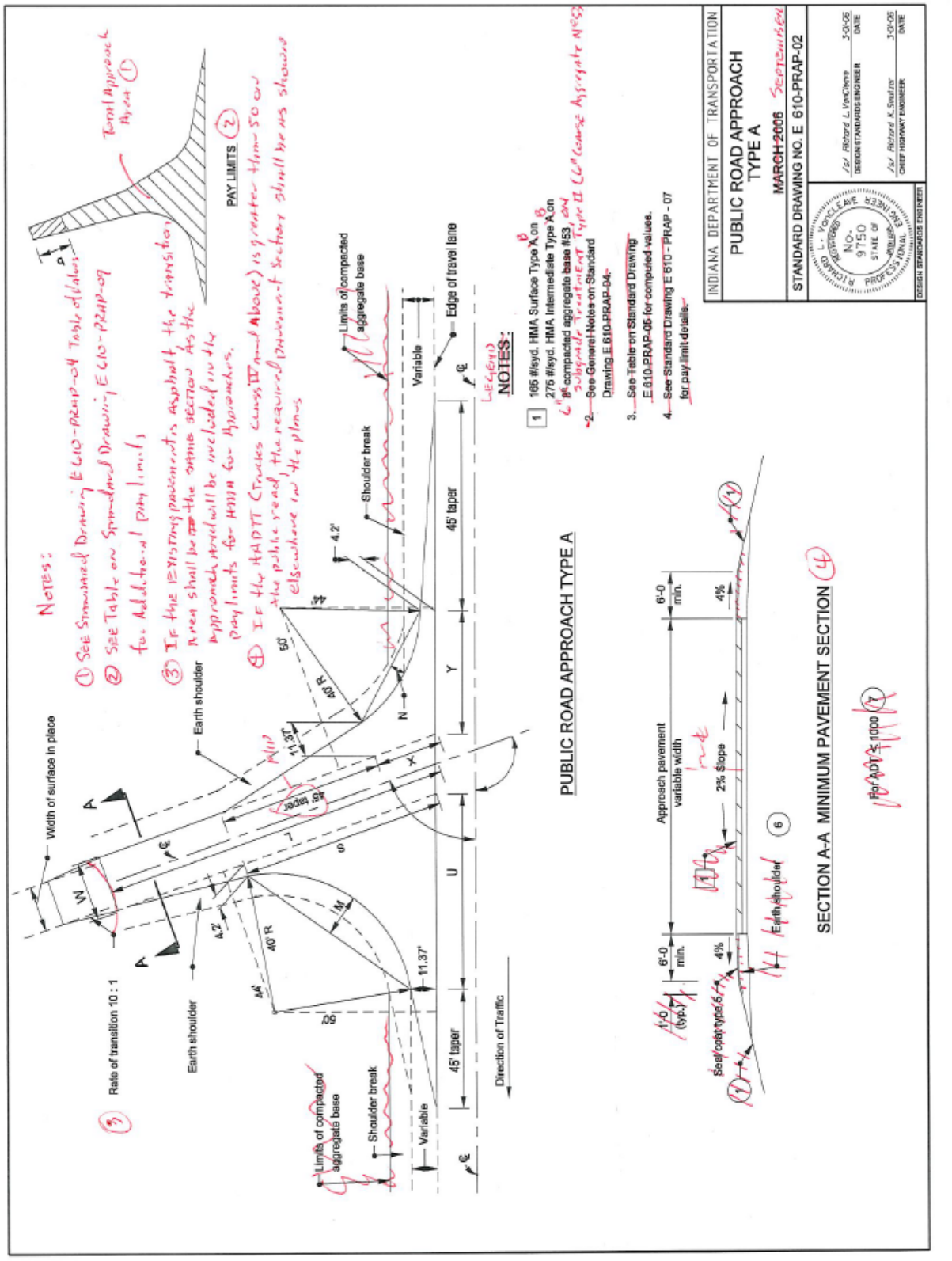
REVISION TO STANDARD DRAWINGS

E 610-PRAP-01 PUBLIC ROAD APPROACH (WITH MARKUPS)



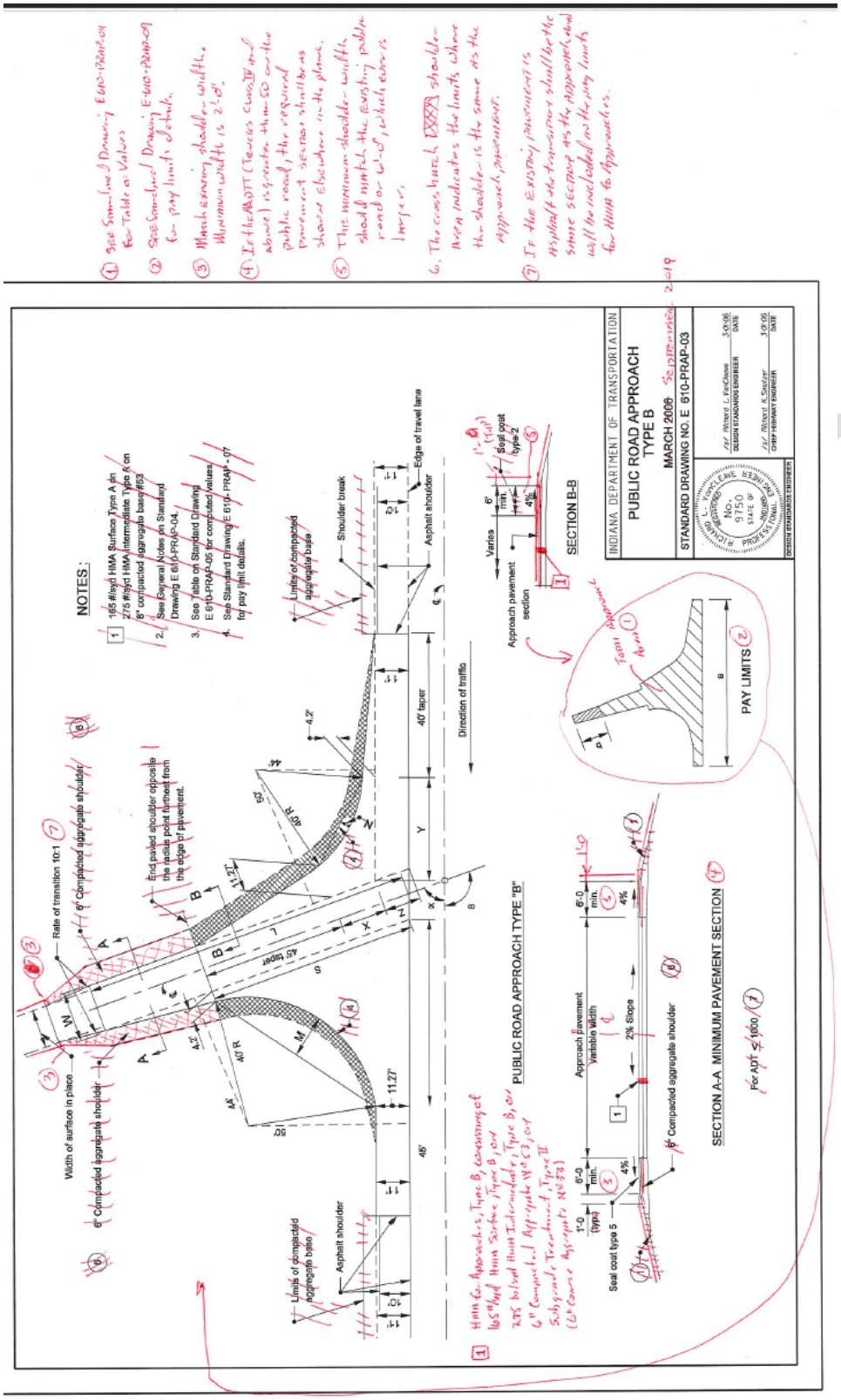
REVISION TO STANDARD DRAWINGS

E 610-PRAP-02 PUBLIC ROAD APPROACH TYPE A (WITH MARKUPS)



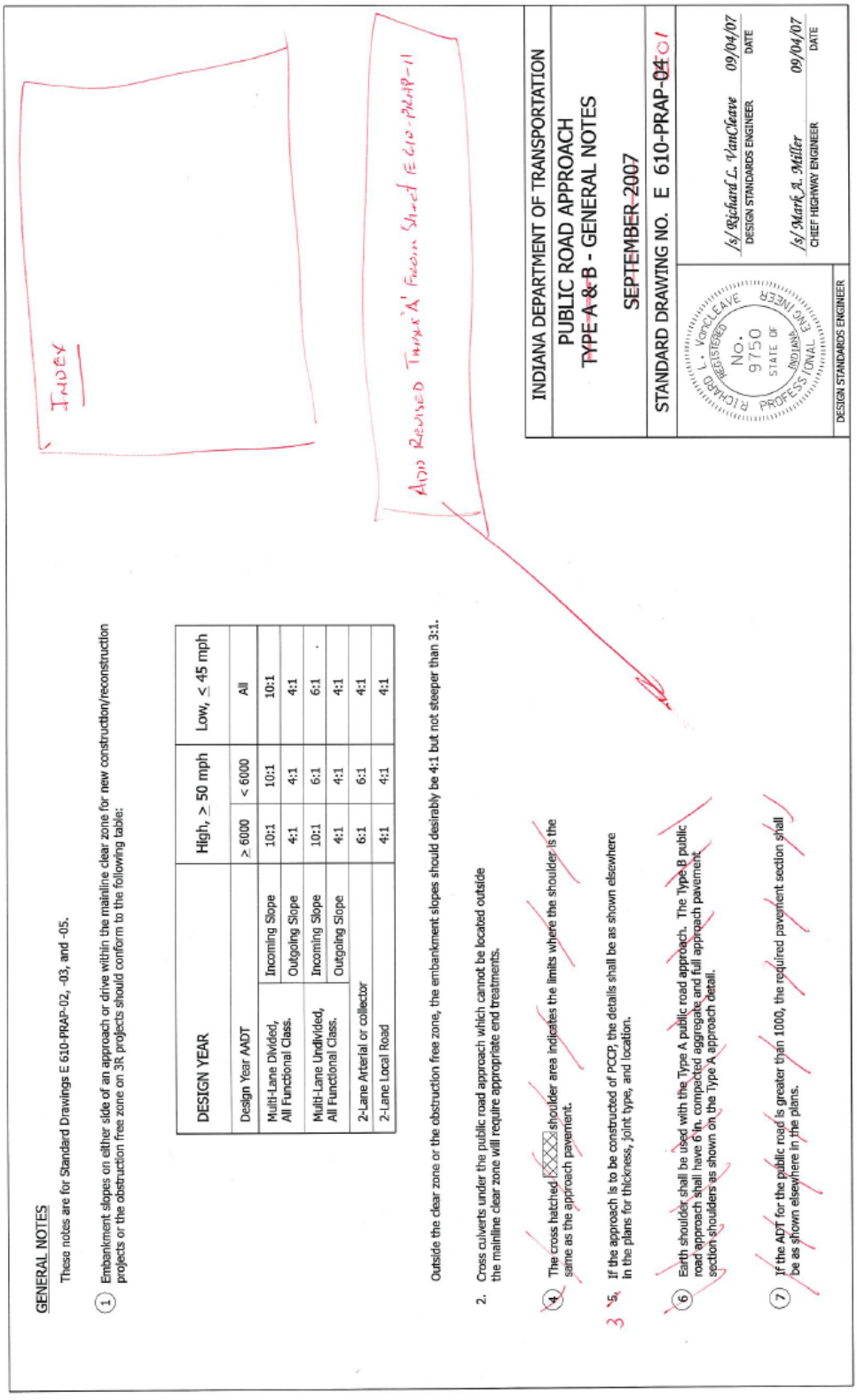
REVISION TO STANDARD DRAWINGS

E 610-PRAP-03 PUBLIC ROAD APPROACH TYPE B (WITH MARKUPS)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-04 PUBLIC ROAD APPROACH TYPE A & B - GENERAL NOTES (WITH MARKUPS)



INDEX

Add Revised Type 'A' Fresh Sheet E 610-PRAP-01

GENERAL NOTES

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

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

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

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

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

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

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

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

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

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH
TYPE A & B - GENERAL NOTES

SEPTEMBER 2007

STANDARD DRAWING NO. E 610-PRAP-04 01

RICHARD L. VANCLEAVE REGISTERED NO. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

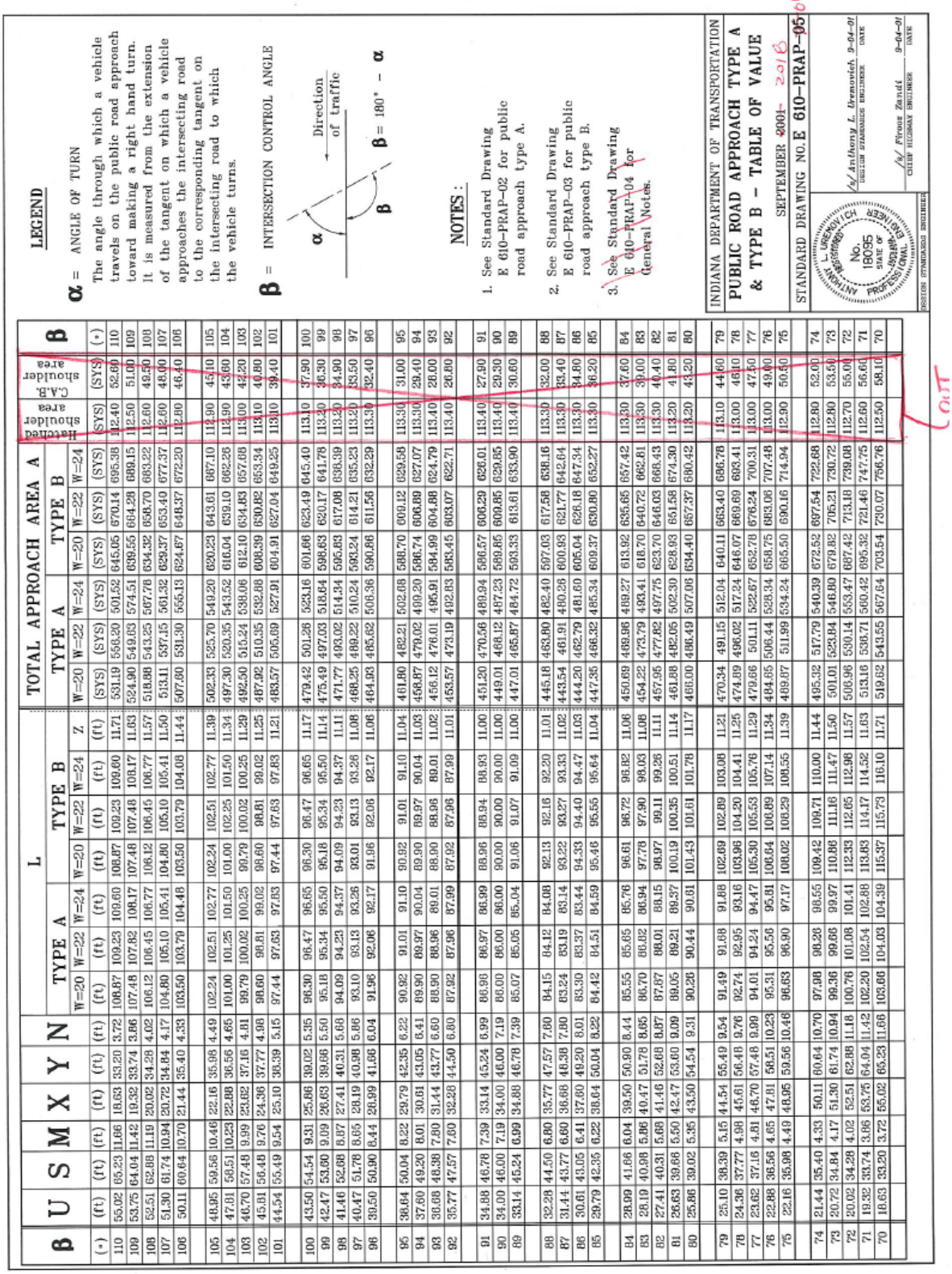
/s/ Richard L. VanCleave 09/04/07
DESIGN STANDARDS ENGINEER DATE

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

DESIGN STANDARDS ENGINEER

REVISION TO STANDARD DRAWINGS

E 610-PRAP-05 PUBLIC ROAD APPROACH TYPE A & TYPE B -TABLE OF VALUE (WITH MARKUPS)



LEGEND

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

β = INTERSECTION CONTROL ANGLE

NOTES:

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

INDIANA DEPARTMENT OF TRANSPORTATION
PUBLIC ROAD APPROACH TYPE A & TYPE B – TABLE OF VALUE
SEPTEMBER 2001 - 2018
STANDARD DRAWING NO. **E 610-PRAP-05** 04

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

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

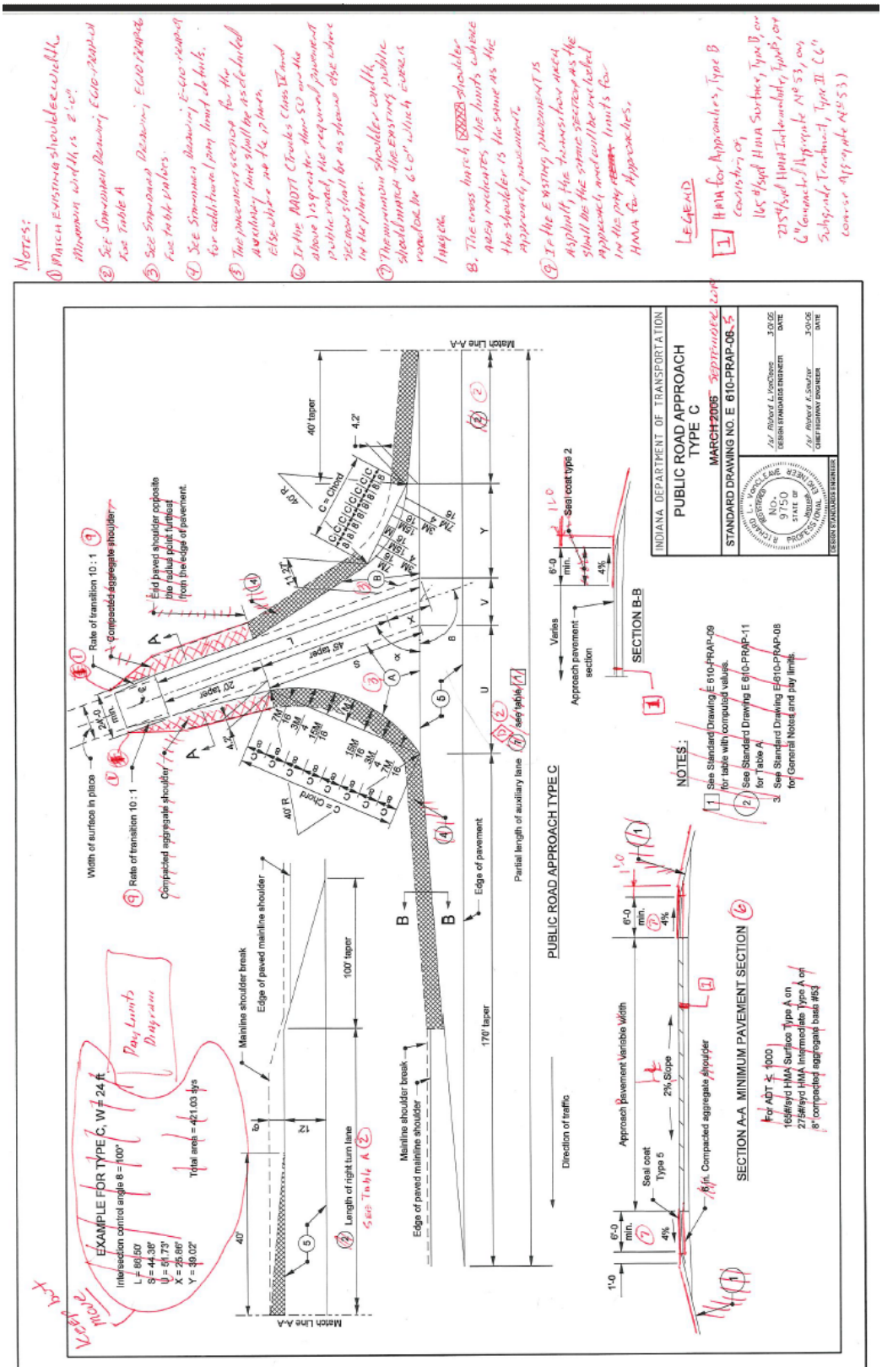
/s/ Firoz Zaveri 9-04-01
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS BRANCH

β	U	S	M	X	Y	N	L TYPE A W=20	L TYPE A W=22	L TYPE A W=24	L TYPE B W=20	L TYPE B W=22	L TYPE B W=24	Z	TOTAL APPROACH AREA A TYPE A W=20	TYPE A W=22	TYPE A W=24	TYPE B W=20	TYPE B W=22	TYPE B W=24	Hatched shoulder area	C.A.B. shoulder area	β
(-)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(SYS)	(-)
110	55.02	65.23	11.66	18.63	33.20	3.72	106.87	109.23	109.60	108.87	109.23	109.60	11.71	531.19	556.20	501.52	645.05	670.14	695.38	112.40	52.60	110
109	53.75	64.04	11.42	19.32	33.74	3.86	107.48	107.82	108.17	107.48	107.82	108.17	11.63	524.90	549.63	574.51	639.55	664.28	689.15	112.50	51.00	109
108	52.51	62.88	11.19	20.02	34.28	4.02	106.12	106.45	106.77	106.45	106.77	106.12	11.57	518.88	543.25	567.78	634.32	658.70	683.22	112.60	49.50	108
107	51.30	61.74	10.94	20.72	34.84	4.17	104.80	105.10	105.41	104.80	105.10	105.41	11.50	513.11	537.15	561.32	629.37	653.40	677.37	112.60	48.00	107
106	50.11	60.64	10.70	21.44	35.40	4.33	103.50	103.79	104.48	103.50	103.79	104.08	11.44	507.80	531.30	555.13	624.67	648.37	672.20	112.80	46.40	106
105	48.95	59.56	10.46	22.16	35.96	4.49	102.24	102.51	102.77	102.24	102.51	102.77	11.39	502.33	525.70	549.20	620.23	643.61	667.10	112.90	45.10	105
104	47.01	58.51	10.23	22.88	36.56	4.65	101.00	101.25	101.50	101.00	102.25	101.50	11.34	497.30	520.35	543.52	616.04	639.10	662.26	113.00	43.60	104
103	46.70	57.48	9.99	23.62	37.16	4.81	99.79	100.02	100.25	99.79	100.02	100.25	11.29	492.50	515.24	538.06	612.10	634.83	657.68	113.00	42.20	103
102	45.01	56.48	9.76	24.36	37.77	4.98	98.60	98.81	99.02	98.60	98.81	99.02	11.25	487.92	510.35	532.86	608.59	630.62	653.34	113.10	40.80	102
101	44.54	55.49	9.54	25.10	38.39	5.15	97.44	97.63	97.83	97.44	97.63	97.83	11.21	483.57	505.69	527.91	604.91	627.04	649.25	113.10	39.40	101
100	43.50	54.54	9.31	25.86	39.02	5.35	96.30	96.47	96.65	96.30	96.47	96.65	11.17	479.42	501.26	523.16	601.66	623.49	645.40	113.10	37.90	100
99	42.47	53.60	9.09	26.63	39.66	5.50	95.18	95.34	95.50	95.18	95.34	95.50	11.14	475.49	497.03	518.64	598.63	620.17	641.78	113.20	36.30	99
98	41.46	52.68	8.87	27.41	40.31	5.68	94.09	94.23	94.37	94.09	94.23	94.37	11.11	471.77	493.02	514.34	595.63	617.08	638.39	113.20	34.90	98
97	40.47	51.78	8.65	28.19	40.98	5.86	93.10	93.13	93.26	93.01	93.13	93.26	11.08	468.25	489.22	510.24	593.24	614.21	635.23	113.20	33.50	97
96	39.50	50.90	8.44	28.99	41.66	6.04	91.96	92.06	92.17	91.96	92.06	92.17	11.06	464.93	485.62	506.36	590.66	611.56	632.29	113.30	32.40	96
95	38.64	50.04	8.22	29.79	42.35	6.22	90.92	91.01	91.10	90.92	91.01	91.10	11.04	461.86	482.21	502.68	586.70	606.12	626.58	113.30	31.00	95
94	37.60	49.20	8.01	30.61	43.05	6.41	89.90	89.97	90.04	89.90	89.97	90.04	11.03	458.87	479.02	499.20	586.74	606.69	627.07	113.30	29.40	94
93	36.68	48.38	7.80	31.44	43.77	6.60	88.90	88.96	89.01	88.90	88.96	89.01	11.02	456.12	476.01	495.91	584.99	604.88	624.79	113.40	28.00	93
92	35.77	47.57	7.60	32.23	44.50	6.80	87.92	87.96	87.99	87.92	87.96	87.99	11.01	453.57	473.19	492.83	583.45	603.07	622.71	113.40	26.80	92
91	34.88	46.78	7.39	33.14	45.24	6.99	86.96	86.97	86.99	88.96	88.94	88.93	11.00	451.20	470.56	489.94	586.57	606.29	626.01	113.40	27.90	91
90	34.00	46.00	7.19	34.00	46.00	7.19	86.00	86.00	86.00	90.00	90.00	90.00	11.00	449.01	468.12	487.23	589.85	609.85	629.85	113.40	29.30	90
89	33.14	45.24	6.99	34.88	46.78	7.39	85.07	85.05	85.04	91.06	91.07	91.09	11.00	447.01	465.87	484.72	593.33	613.61	633.90	113.40	30.60	89
88	32.28	44.50	6.80	35.77	47.57	7.60	84.15	84.12	84.08	92.13	92.16	92.20	11.01	445.16	463.80	482.40	597.03	617.58	638.16	113.30	32.00	88
87	31.44	43.77	6.60	36.66	48.38	7.80	83.24	83.19	83.14	93.22	93.27	93.33	11.02	443.54	461.91	480.26	600.93	621.77	642.64	113.30	33.40	87
86	30.61	43.05	6.41	37.60	49.20	8.01	83.30	83.37	83.44	94.33	94.40	94.47	11.03	444.20	462.79	481.60	605.04	626.18	647.34	113.30	34.80	86
85	29.79	42.35	6.22	38.64	50.04	8.22	84.42	84.51	84.59	95.46	95.55	95.64	11.04	447.35	466.32	485.34	609.37	630.80	652.27	113.30	36.20	85
84	28.99	41.66	6.04	39.50	50.90	8.44	85.55	85.65	85.76	96.61	96.72	96.82	11.06	450.69	469.96	489.27	613.92	635.85	657.42	113.30	37.60	84
83	28.19	40.98	5.86	40.47	51.78	8.65	86.70	86.82	86.94	97.78	97.90	98.03	11.06	454.22	473.79	493.41	618.70	640.72	662.81	113.30	38.00	83
82	27.41	40.31	5.68	41.46	52.68	8.87	87.87	88.01	88.15	98.97	99.11	99.26	11.11	457.95	477.82	497.75	623.70	646.03	668.43	113.30	40.40	82
81	26.63	39.66	5.50	42.47	53.60	9.09	89.05	89.21	89.37	100.19	100.35	100.51	11.14	461.88	482.05	502.30	628.93	651.58	674.30	113.20	41.80	81
80	25.86	39.02	5.35	43.50	54.54	9.31	90.26	90.44	90.61	101.43	101.61	101.78	11.17	466.00	486.49	507.06	634.40	657.37	680.42	113.20	43.20	80
79	25.10	38.39	5.15	44.54	55.49	9.54	91.49	91.68	91.88	102.69	102.89	103.08	11.21	470.34	491.15	512.04	640.11	663.40	686.78	113.10	44.60	79
78	24.36	37.77	4.98	45.61	56.48	9.76	92.74	92.95	93.16	103.96	104.20	104.41	11.25	474.89	496.02	517.24	646.07	669.69	693.41	113.00	46.10	78
77	23.62	37.16	4.81	46.70	57.48	9.99	94.01	94.24	94.47	105.30	105.53	105.76	11.29	479.66	501.11	522.67	652.78	676.24	700.31	113.00	47.50	77
76	22.98	36.56	4.65	47.81	58.51	10.23	95.31	95.58	95.81	106.64	106.89	107.14	11.34	484.65	506.44	528.34	658.75	683.06	707.48	113.00	49.00	76
75	22.16	35.96	4.49	48.95	59.56	10.46	96.63	96.90	97.17	108.02	108.29	108.55	11.39	489.87	511.99	534.24	665.50	690.16	714.94	112.90	50.50	75
74	21.44	35.40	4.33	50.11	60.64	10.70	97.98	98.28	98.55	109.42	109.71	110.00	11.44	495.32	517.79	540.39	672.52	697.54	722.68	112.80	52.00	74
73	20.72	34.84	4.17	51.30	61.74	10.94	99.36	99.66	99.97	110.96	111.16	111.47	11.50	501.01	523.84	546.80	679.82	705.21	730.72	112.80	53.50	73
72	20.02	34.28	4.02	52.51	62.88	11.18	100.76	101.08	101.41	112.33	112.65	112.98	11.57	506.96	530.14	553.47	687.42	713.18	739.08	112.70	55.00	72
71	19.32	33.74	3.86	53.75	64.04	11.42	102.20	102.54	102.88	113.83	114.17	114.52	11.63	513.16	536.71	560.42	695.32	721.46	747.75	112.60	56.60	71
70	18.63	33.20	3.72	55.02	65.23	11.66	103.66	104.03	104.39	115.37	115.73	116.10	11.71	519.62	543.55	567.64	703.54	730.07	756.76	112.50	58.10	70

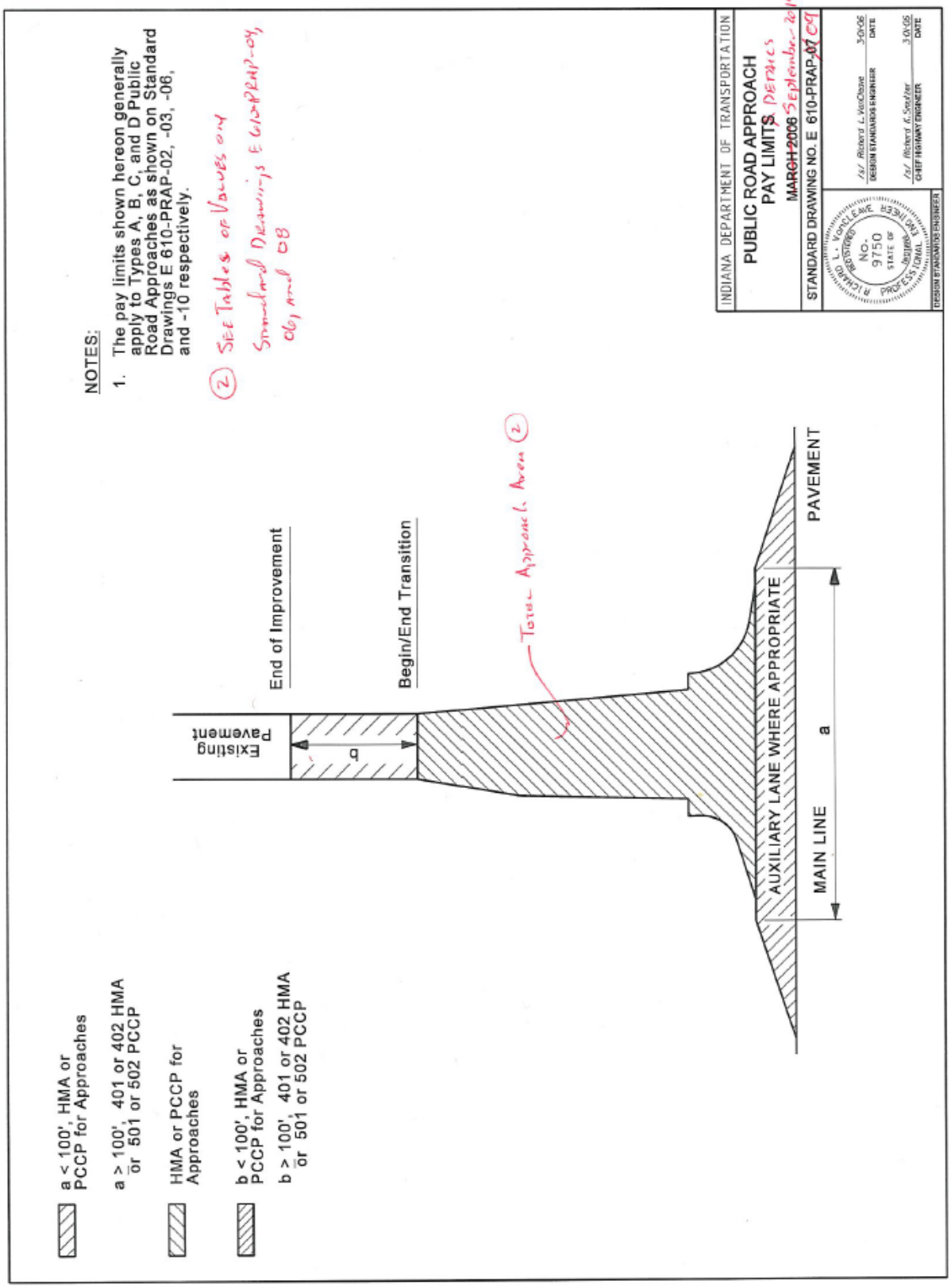
REVISION TO STANDARD DRAWINGS

E 610-PRAP-06 PUBLIC ROAD APPROACH TYPE C (WITH MARKUPS)



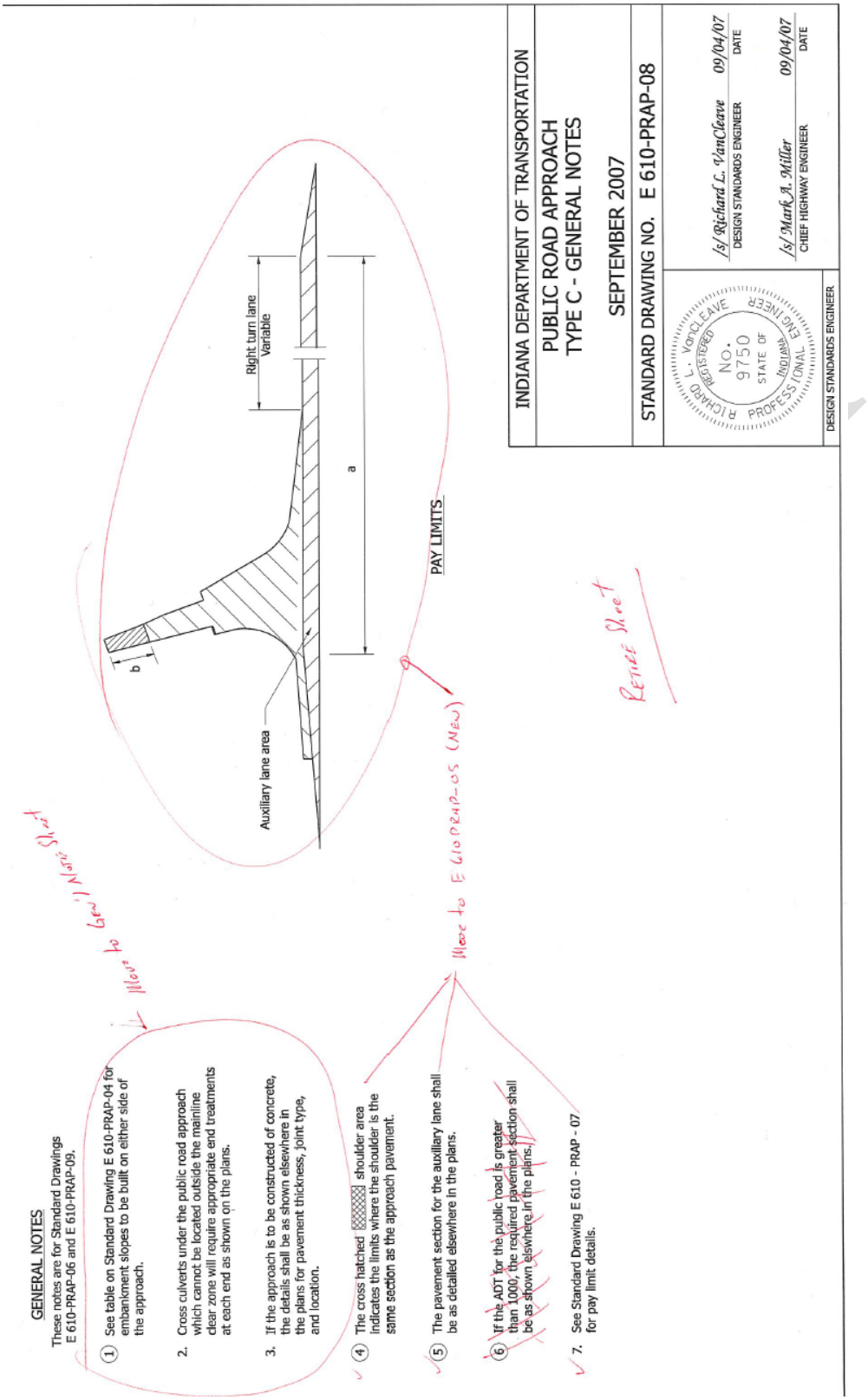
REVISION TO STANDARD DRAWINGS

E 610-PRAP-07 PUBLIC ROAD APPROACH PAY LIMITS (WITH MARKUPS)



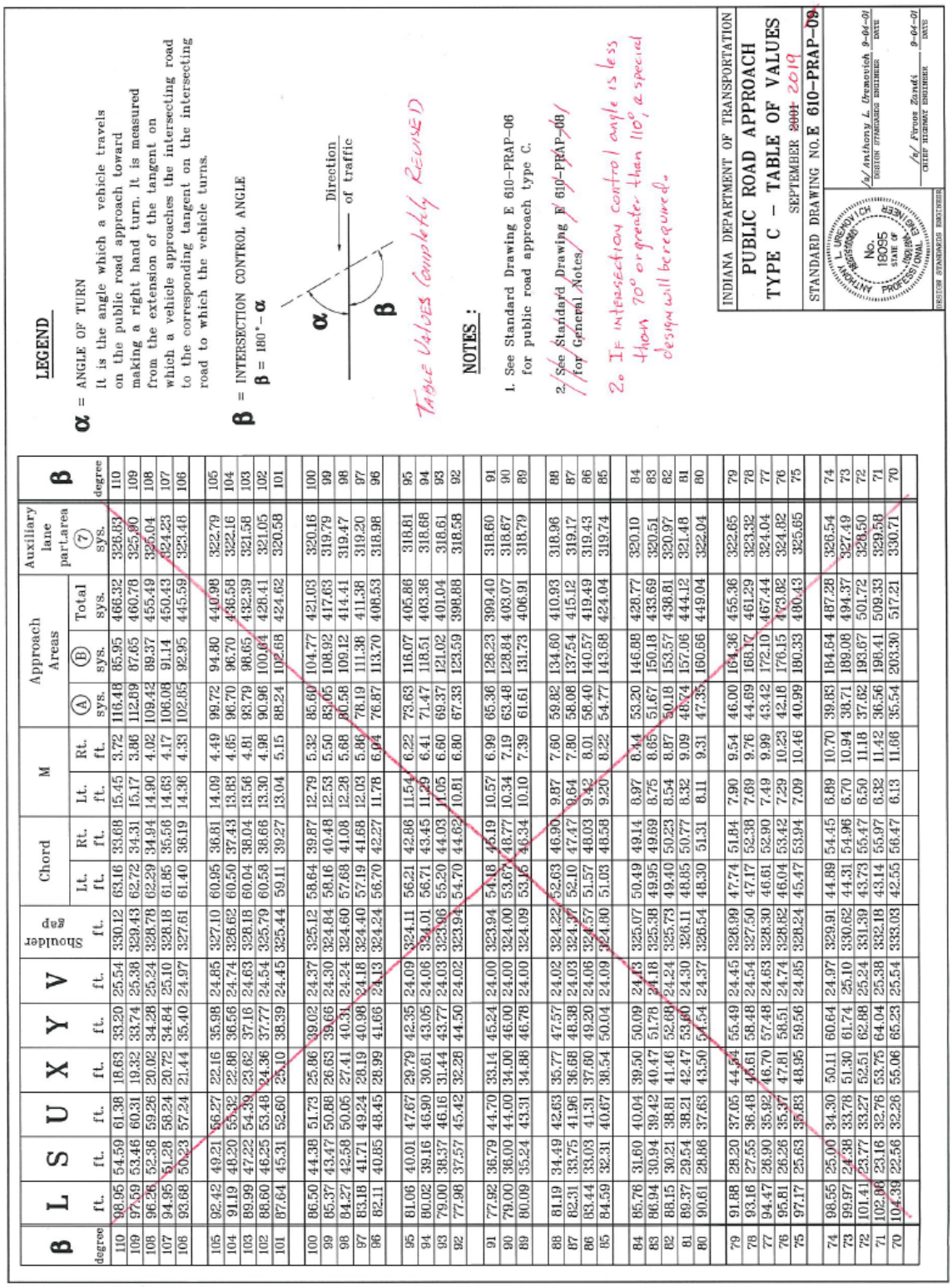
REVISION TO STANDARD DRAWINGS

E 610-PRAP-08 PUBLIC ROAD APPROACH TYPE C - GENERAL NOTES (WITH MARKUPS)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-09 PUBLIC ROAD APPROACH TYPE C - TABLE OF VALUES (WITH MARKUPS)



LEGEND

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

β = INTERSECTION CONTROL ANGLE
β = 180° − α

α Direction of traffic β

Table Values (empirically Revised)

NOTES :

1. See Standard Drawing E 610-PRAP-06 for public road approach type C.
2. See Standard Drawing E 610-PRAP-09 for General Notes.
2. If intersection control angle is less than 70° or greater than 110°, a special design will be required.

INDIANA DEPARTMENT OF TRANSPORTATION
PUBLIC ROAD APPROACH
TYPE C – TABLE OF VALUES
SEPTEMBER ~~2001~~ 2019
STANDARD DRAWING NO. E 610-PRAP-09

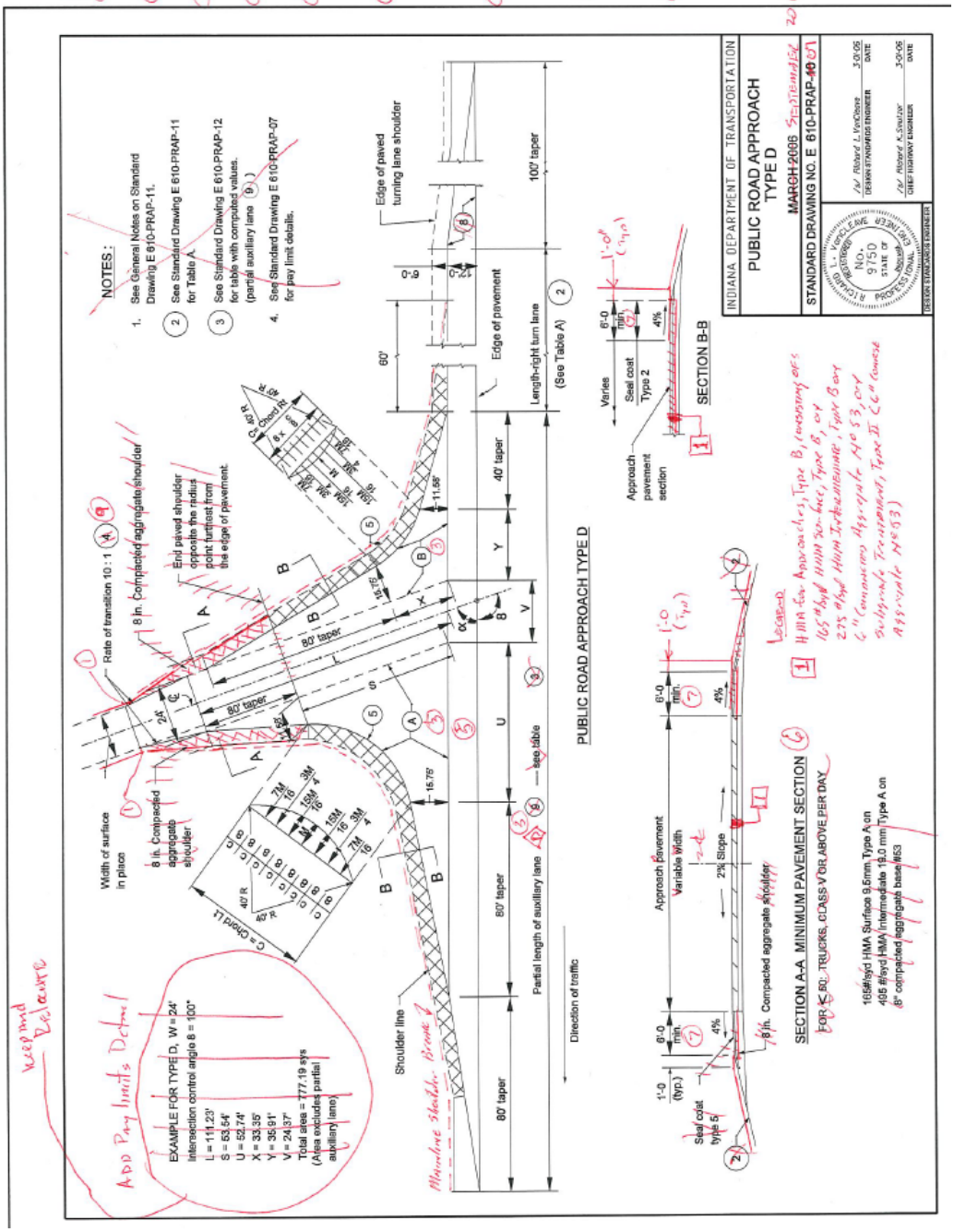
L. URSKOVICH No. 18095 STATE OF INDIANA REGISTERED PROFESSIONAL ENGINEER

/s/ Anthony L. Uranovich 9-04-01
DESIGN STANDARDS ENGINEER — DATE
/s/ Firuz Zandi 9-04-01
CHIEF HIGHWAY ENGINEER — DATE

β degree	L ft.	S ft.	U ft.	X ft.	Y ft.	V ft.	Shoulder gap ft.	Chord Lt. ft.	Chord Rt. ft.	M Lt. ft.	M Rt. ft.	Approach Areas (A) sys.	Approach Areas (B) sys.	Approach Areas Total sys.	Auxiliary lane part.area (7) sys.	β degree
110	98.95	54.59	61.38	18.63	33.20	25.54	330.12	63.16	33.68	15.45	3.72	116.48	85.95	466.32	326.83	110
109	97.59	53.46	60.31	19.32	33.74	25.38	329.43	62.72	34.31	15.17	3.86	112.89	87.65	460.78	325.90	109
108	96.26	52.36	59.26	20.02	34.28	25.24	328.78	62.29	34.94	14.90	4.02	109.42	89.37	455.49	325.04	108
107	94.95	51.28	58.24	20.72	34.84	25.10	328.18	61.85	35.56	14.63	4.17	106.08	91.14	450.43	324.23	107
106	93.68	50.23	57.24	21.44	35.40	24.97	327.61	61.40	36.19	14.36	4.33	102.85	92.95	445.59	323.40	106
105	92.42	49.21	56.27	22.16	35.98	24.85	327.10	60.95	36.81	14.09	4.49	99.72	94.80	440.98	322.79	105
104	91.19	48.20	55.32	22.88	36.56	24.74	326.62	60.50	37.43	13.83	4.65	96.70	96.70	436.58	322.16	104
103	89.99	47.22	54.39	23.62	37.16	24.63	328.18	60.04	38.04	13.56	4.81	93.79	98.65	432.39	321.58	103
102	88.80	46.25	53.48	24.36	37.77	24.54	325.79	60.58	38.66	13.30	4.98	90.96	100.64	428.41	321.05	102
101	87.64	45.31	52.60	25.10	38.39	24.45	325.44	59.11	39.27	13.04	5.15	88.24	102.68	424.62	320.58	101
100	86.50	44.38	51.73	25.86	39.02	24.37	325.12	58.64	39.87	12.79	5.32	85.60	104.77	421.03	320.16	100
99	85.37	43.47	50.88	26.63	39.66	24.30	324.84	58.16	40.48	12.53	5.50	83.05	108.92	417.63	319.79	99
98	84.27	42.58	50.05	27.41	40.31	24.24	324.60	57.68	41.08	12.28	5.68	80.58	109.12	414.41	319.47	98
97	83.18	41.71	49.24	28.19	40.96	24.18	324.40	57.19	41.68	12.03	5.86	78.19	111.38	411.38	319.20	97
96	82.11	40.85	48.45	28.99	41.66	24.13	324.24	56.70	42.27	11.78	6.04	76.87	113.70	408.53	318.98	96
95	81.06	40.01	47.67	29.79	42.35	24.09	324.11	56.21	42.86	11.54	6.22	73.63	116.07	405.86	318.81	95
94	80.02	39.16	46.90	30.61	43.05	24.06	324.01	56.71	43.45	11.29	6.41	71.47	118.51	403.36	318.68	94
93	79.00	38.37	46.16	31.44	43.77	24.03	323.96	55.20	44.03	11.05	6.60	69.37	121.02	401.04	318.61	93
92	77.98	37.57	45.42	32.26	44.50	24.02	323.94	54.70	44.62	10.81	6.80	67.33	123.59	398.88	318.58	92
91	77.92	36.79	44.70	33.14	45.24	24.00	323.94	54.18	45.19	10.57	6.99	65.36	126.23	399.40	318.60	91
90	79.00	36.00	44.00	34.00	46.00	24.00	324.00	53.67	46.77	10.34	7.19	63.48	128.84	403.07	318.67	90
89	80.09	35.24	43.31	34.88	46.78	24.00	324.09	53.16	46.34	10.10	7.39	61.61	131.73	406.91	318.79	89
88	81.19	34.49	42.63	35.77	47.57	24.02	324.22	52.63	46.90	9.87	7.60	59.82	134.60	410.93	318.96	88
87	82.31	33.75	41.96	36.68	48.38	24.03	324.37	52.10	47.47	9.64	7.80	58.08	137.54	415.12	319.17	87
86	83.44	33.03	41.31	37.60	49.20	24.06	324.57	51.57	48.03	9.42	8.01	56.40	140.57	419.49	319.43	86
85	84.59	32.31	40.67	38.54	50.04	24.09	324.80	51.03	48.58	9.20	8.22	54.77	143.68	424.04	319.74	85
84	85.76	31.60	40.04	39.50	50.09	24.13	325.07	50.49	49.14	8.97	8.44	53.20	146.88	428.77	320.10	84
83	86.94	30.94	39.42	40.47	51.78	24.18	325.38	49.95	49.69	8.75	8.65	51.67	150.18	433.69	320.51	83
82	88.15	30.21	38.81	41.46	52.60	24.24	325.73	49.40	50.23	8.54	8.87	50.18	153.57	438.81	320.97	82
81	89.37	29.54	38.21	42.47	53.40	24.30	326.11	48.85	50.77	8.32	9.09	48.74	157.06	444.12	321.48	81
80	90.61	28.86	37.63	43.50	54.54	24.37	326.54	48.30	51.31	8.11	9.31	47.35	160.66	449.04	322.04	80
79	91.88	28.20	37.05	44.54	55.49	24.45	326.99	47.74	51.84	7.90	9.54	46.00	164.36	455.36	322.65	79
78	93.16	27.55	36.48	45.61	56.48	24.54	327.50	47.17	52.38	7.69	9.76	44.69	168.17	461.29	323.32	78
77	94.47	26.90	35.92	46.70	57.48	24.63	328.30	46.61	52.90	7.49	9.99	43.42	172.10	467.44	324.04	77
76	95.81	26.26	35.37	47.81	58.51	24.74	328.82	46.04	53.42	7.29	10.23	42.16	176.15	473.82	324.82	76
75	97.17	25.63	34.83	48.95	59.56	24.85	328.24	45.47	53.94	7.09	10.46	40.99	180.33	480.43	325.65	75
74	98.55	25.00	34.30	50.11	60.64	24.97	329.91	44.89	54.45	6.89	10.70	39.83	184.64	487.28	326.54	74
73	99.97	24.38	33.78	51.30	61.74	25.10	330.62	44.31	54.96	6.70	10.94	38.71	189.06	494.37	327.49	73
72	101.41	23.77	33.27	52.51	62.88	25.24	331.39	43.73	55.47	6.50	11.18	37.62	193.67	501.72	328.50	72
71	102.90	23.16	32.76	53.75	64.04	25.38	332.18	43.14	55.97	6.32	11.42	36.56	198.41	509.33	329.58	71
70	104.39	22.56	32.26	55.06	65.23	25.54	333.03	42.55	56.47	6.13	11.66	35.54	203.30	517.21	330.71	70

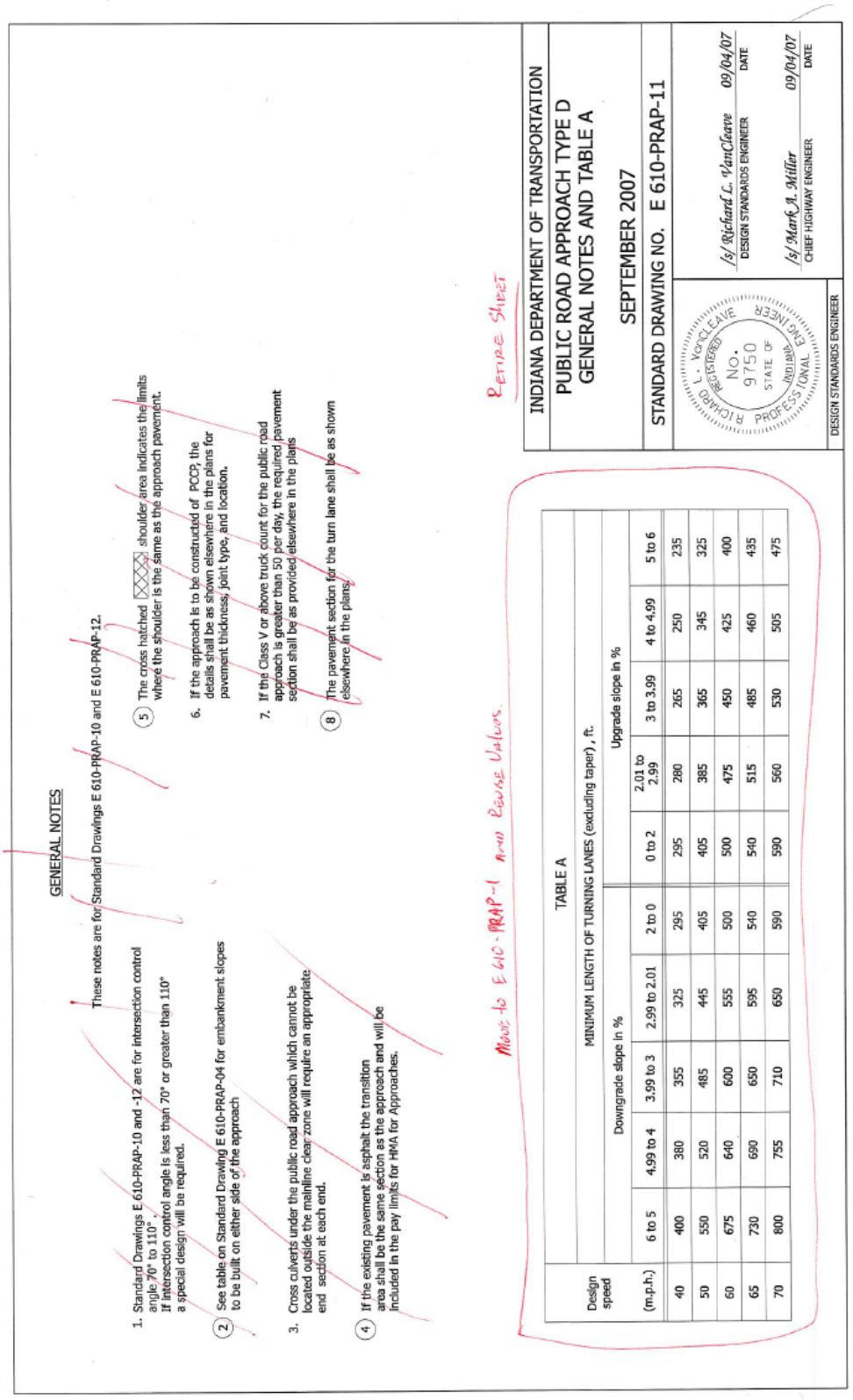
REVISION TO STANDARD DRAWINGS

E 610-PRAP-10 PUBLIC ROAD APPROACH TYPE D (WITH MARKUPS)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-11 PUBLIC ROAD APPROACH TYPE D GENERAL NOTES AND TABLE A (WITH MARKUPS)



GENERAL NOTES

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

1. Standard Drawings E 610-PRAP-10 and -12 are for intersection control angle 70° to 110°. If intersection control angle is less than 70° or greater than 110° a special design will be required.
2. See table on Standard Drawing E 610-PRAP-04 for embankment slopes to be built on either side of the approach
3. Cross culverts under the public road approach which cannot be located outside the mainline clear zone will require an appropriate end section at each end.
4. If the existing pavement is asphalt the transition area shall be the same section as the approach and will be included in the pay limits for HMA for Approaches.
5. The cross hatched shoulder area indicates the limits where the shoulder is the same as the approach pavement.
6. If the approach is to be constructed of PCCP, the details shall be as shown elsewhere in the plans for pavement thickness, joint type, and location.
7. If the Class V or above truck count for the public road approach is greater than 50 per day, the required pavement section shall be as provided elsewhere in the plans
8. The pavement section for the turn lane shall be as shown elsewhere in the plans.

Remove Sheet

Move to E 610-PRAP-1 and Revise Values.

TABLE A

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

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH TYPE D
GENERAL NOTES AND TABLE A

SEPTEMBER 2007

STANDARD DRAWING NO. E 610-PRAP-11

REGISTERED RICHARD L. VANCLEAVE NO. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

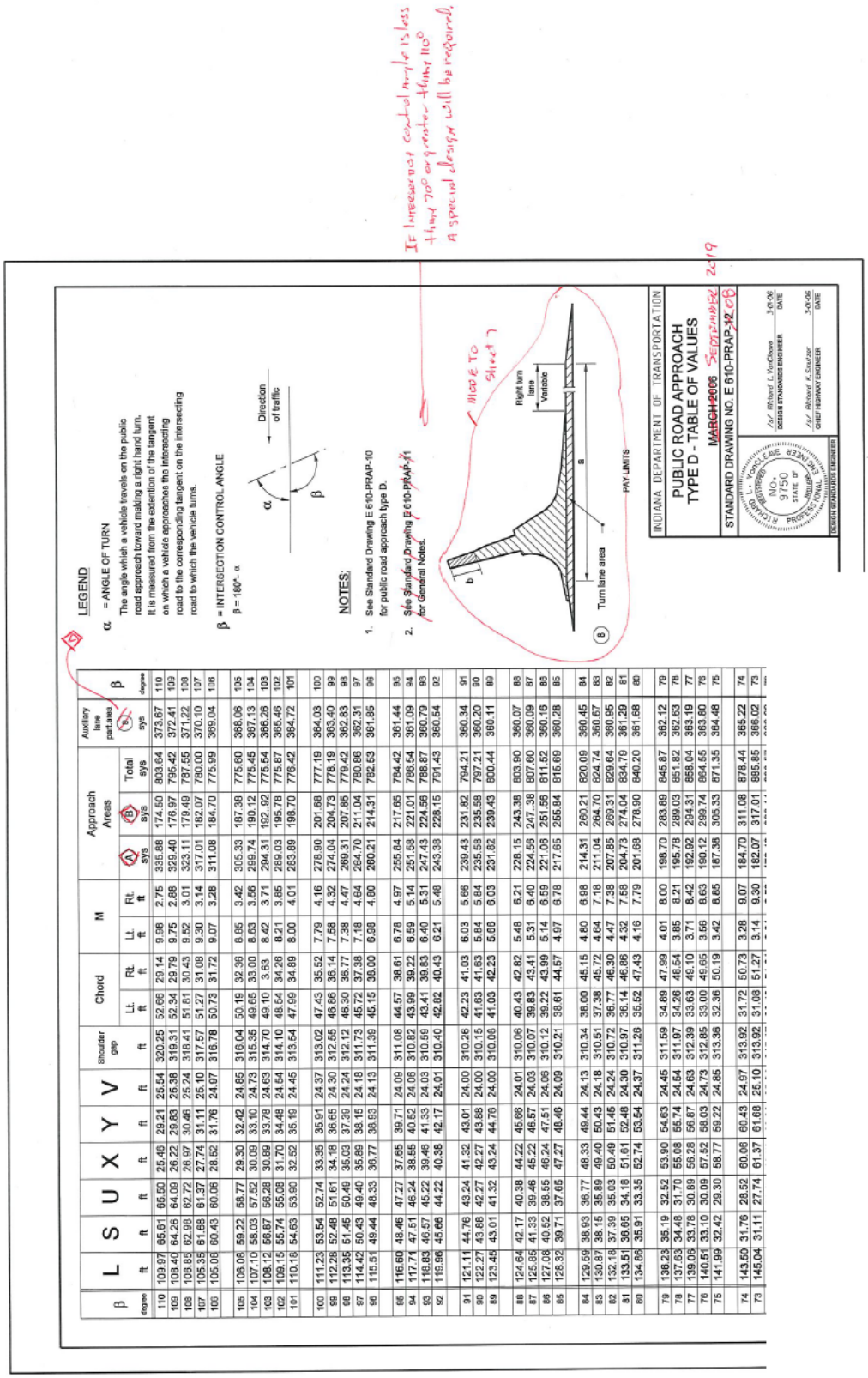
/s/ Richard L. VanCleave 09/04/07
DESIGN STANDARDS ENGINEER DATE

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

DESIGN STANDARDS ENGINEER

REVISION TO STANDARD DRAWINGS

E 610-PRAP-12 PUBLIC ROAD APPROACH TYPE D - TABLE OF VALUES (WITH MARKUPS)



β	L	S	U	X	Y	V	Shoulder gap	Chord		M		Approach Areas			Auxiliary lane part area	β
degree	ft	ft	ft	ft	ft	ft	ft	Lt. ft	Rt. ft	Lt. ft	Rt. ft	(A) sys	(B) sys	Total sys	(B) sys	degree
110	109.97	65.61	65.50	25.46	29.21	25.54	320.25	52.66	29.14	9.98	2.75	335.86	174.50	803.64	373.67	110
109	108.40	64.26	64.09	26.22	29.83	25.38	319.31	52.34	29.79	9.75	2.88	329.40	176.97	796.42	372.41	109
108	106.85	62.98	62.72	26.97	30.46	25.24	318.41	51.61	30.43	9.52	3.01	323.11	179.49	787.55	371.22	108
107	105.35	61.88	61.37	27.74	31.11	25.10	317.57	51.27	31.08	9.30	3.14	317.01	182.07	780.00	370.10	107
106	105.09	60.43	60.06	28.52	31.76	24.97	316.78	50.73	31.72	9.07	3.28	311.06	184.70	775.99	369.04	106
105	106.06	59.22	58.77	29.30	32.42	24.85	316.04	50.19	32.36	8.85	3.42	305.33	187.38	775.60	368.06	105
104	107.10	58.03	57.52	30.09	33.10	24.73	315.35	49.65	33.00	8.63	3.56	299.74	190.12	775.45	367.13	104
103	108.12	56.87	56.28	30.89	33.78	24.63	314.70	49.10	3.63	8.42	3.71	294.31	192.92	775.54	366.26	103
102	109.15	55.74	55.08	31.70	34.48	24.54	314.10	48.54	34.28	8.21	3.85	289.03	195.78	775.87	365.46	102
101	110.18	54.63	53.90	32.52	35.19	24.45	313.54	47.99	34.89	8.00	4.01	283.89	198.70	776.42	364.72	101
100	111.23	53.54	52.74	33.35	35.91	24.37	313.02	47.43	35.52	7.79	4.16	278.90	201.68	777.19	364.03	100
99	112.28	52.48	51.61	34.18	36.65	24.30	312.55	46.86	36.14	7.58	4.32	274.04	204.73	778.19	363.40	99
98	113.35	51.45	50.49	35.03	37.39	24.24	312.12	46.30	36.77	7.38	4.47	269.31	207.85	779.42	362.83	98
97	114.42	50.43	49.40	35.89	38.15	24.18	311.73	45.72	37.38	7.18	4.64	264.70	211.04	780.86	362.31	97
96	115.51	49.44	48.33	36.77	38.93	24.13	311.39	45.15	38.00	6.98	4.80	260.21	214.31	782.53	361.85	96
95	116.60	48.46	47.27	37.65	39.71	24.09	311.08	44.57	38.61	6.78	4.97	255.84	217.65	784.42	361.44	95
94	117.74	47.51	46.24	38.55	40.52	24.06	310.82	43.99	39.22	6.59	5.14	251.58	221.01	786.54	361.09	94
93	118.83	46.57	45.22	39.46	41.33	24.03	310.59	43.41	39.83	6.40	5.31	247.43	224.56	788.87	360.79	93
92	119.96	45.66	44.22	40.38	42.17	24.01	310.40	42.82	40.43	6.21	5.48	243.38	228.15	791.43	360.54	92
91	121.11	44.76	43.24	41.32	43.01	24.00	310.26	42.23	41.03	6.03	5.66	239.43	231.82	794.21	360.34	91
90	122.27	43.88	42.27	42.27	43.88	24.00	310.15	41.63	41.63	5.84	5.84	235.58	235.58	797.21	360.20	90
89	123.45	43.01	41.32	43.24	44.76	24.00	310.08	41.03	42.23	5.66	6.03	231.82	239.43	800.44	360.11	89
88	124.64	42.17	40.38	44.22	45.66	24.01	310.06	40.43	42.82	5.48	6.21	228.15	243.38	803.90	360.07	88
87	125.85	41.33	39.46	45.22	46.57	24.03	310.07	39.83	43.41	5.31	6.40	224.56	247.36	807.60	360.09	87
86	127.08	40.52	38.55	46.24	47.51	24.06	310.12	39.22	43.99	5.14	6.59	221.06	251.56	811.52	360.16	86
85	128.32	39.71	37.65	47.27	48.46	24.09	310.21	38.61	44.57	4.97	6.78	217.65	255.84	815.69	360.28	85
84	129.58	38.93	36.77	48.33	49.44	24.13	310.34	38.00	45.15	4.80	6.98	214.31	260.21	820.09	360.45	84
83	130.87	38.15	35.89	49.40	50.43	24.18	310.51	37.38	45.72	4.64	7.18	211.04	264.70	824.74	360.67	83
82	132.18	37.39	35.03	50.49	51.45	24.24	310.72	36.77	46.30	4.47	7.38	207.85	269.31	829.64	360.95	82
81	133.51	36.65	34.18	51.61	52.48	24.30	310.97	36.14	46.86	4.32	7.58	204.73	274.04	834.79	361.29	81
80	134.86	35.91	33.35	52.74	53.54	24.37	311.28	35.52	47.43	4.16	7.79	201.68	278.90	840.20	361.68	80
79	136.23	35.19	32.52	53.90	54.63	24.45	311.59	34.89	47.99	4.01	8.00	198.70	283.89	845.87	362.12	79
78	137.63	34.48	31.70	55.08	55.74	24.54	311.97	34.28	46.54	3.85	8.21	195.78	289.03	851.82	362.63	78
77	139.06	33.78	30.89	56.28	56.87	24.63	312.39	33.63	49.10	3.71	8.42	192.92	294.31	858.04	363.19	77
76	140.51	33.10	30.09	57.52	58.03	24.73	312.85	33.00	49.65	3.56	8.63	190.12	299.74	864.85	363.80	76
75	141.99	32.42	29.30	58.77	59.22	24.85	313.36	32.36	50.19	3.42	8.85	187.38	305.33	871.35	364.48	75
74	143.50	31.76	28.52	60.06	60.43	24.97	313.92	31.72	50.73	3.28	9.07	184.70	311.06	878.44	365.22	74
73	145.04	31.11	27.74	61.37	61.68	25.10	313.92	31.08	51.27	3.14	9.30	182.07	317.01	885.85	366.02	73

LEGEND

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

β = INTERSECTION CONTROL ANGLE
β = 180° - α

α
Direction of traffic
β

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

If intersection control angle is less than 70° or greater than 110° A special design will be required.

Refer to Sheet 1

b
a
Right turn lane Variable
Turn lane area
PAY LIMITS

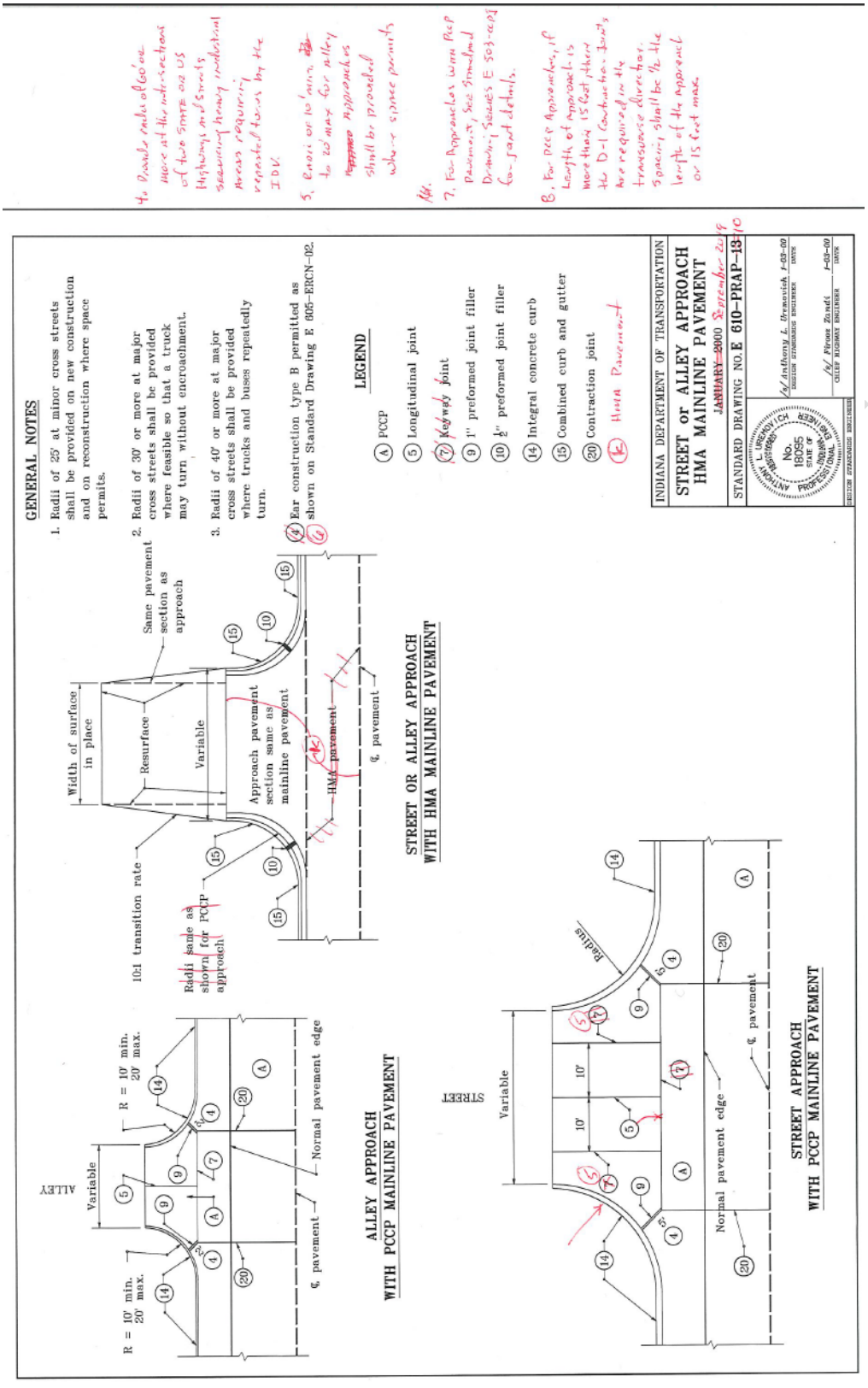
INDIANA DEPARTMENT OF TRANSPORTATION
PUBLIC ROAD APPROACH TYPE D - TABLE OF VALUES
STANDARD DRAWING NO. E 610-PRAP-12
MARCH 2006 September 2019

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

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

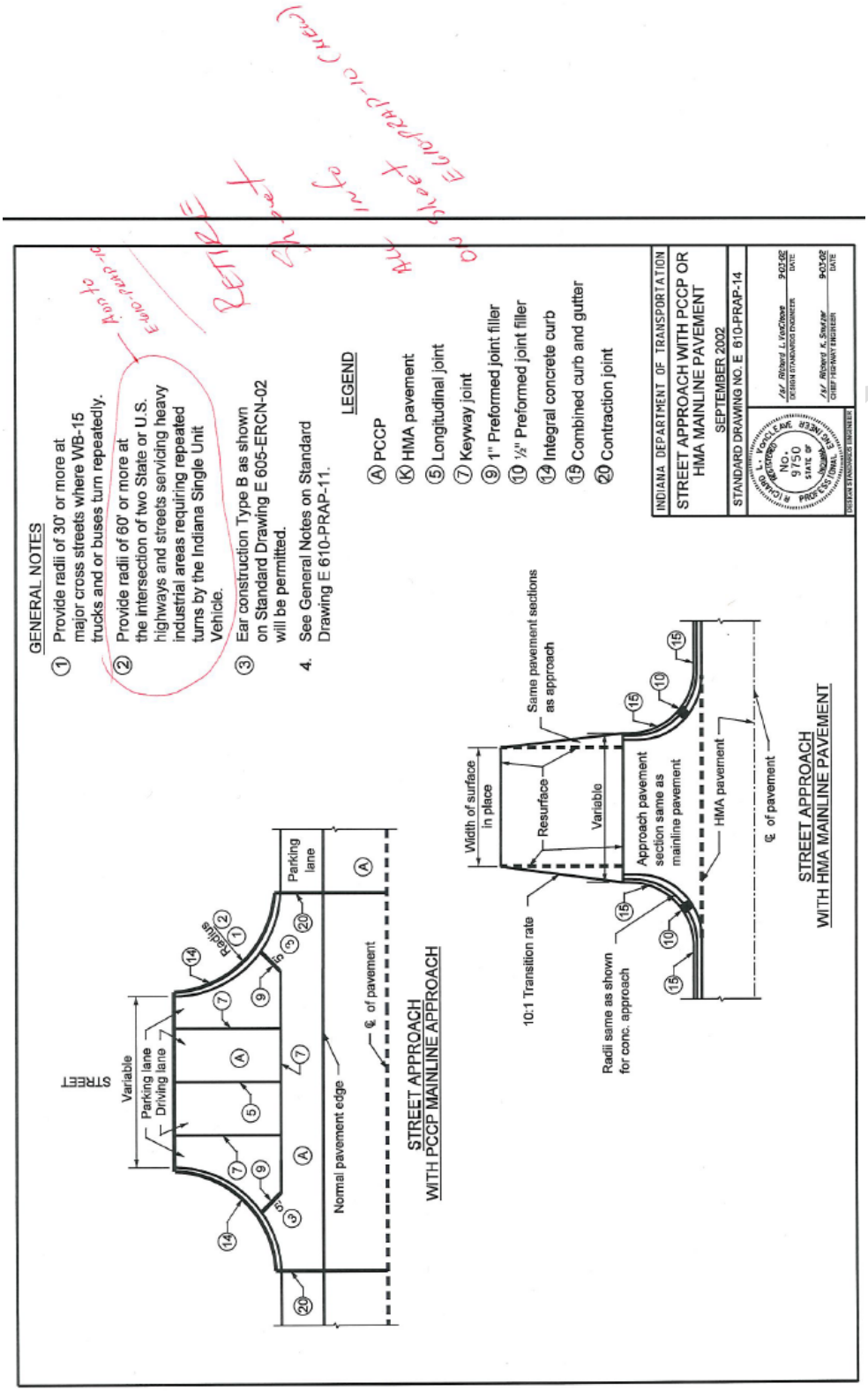
REVISION TO STANDARD DRAWINGS

E 610-PRAP-13 STREET OR VALLEY APPROACH HMA MAINLINE PAVEMENT (WITH MARKUPS)



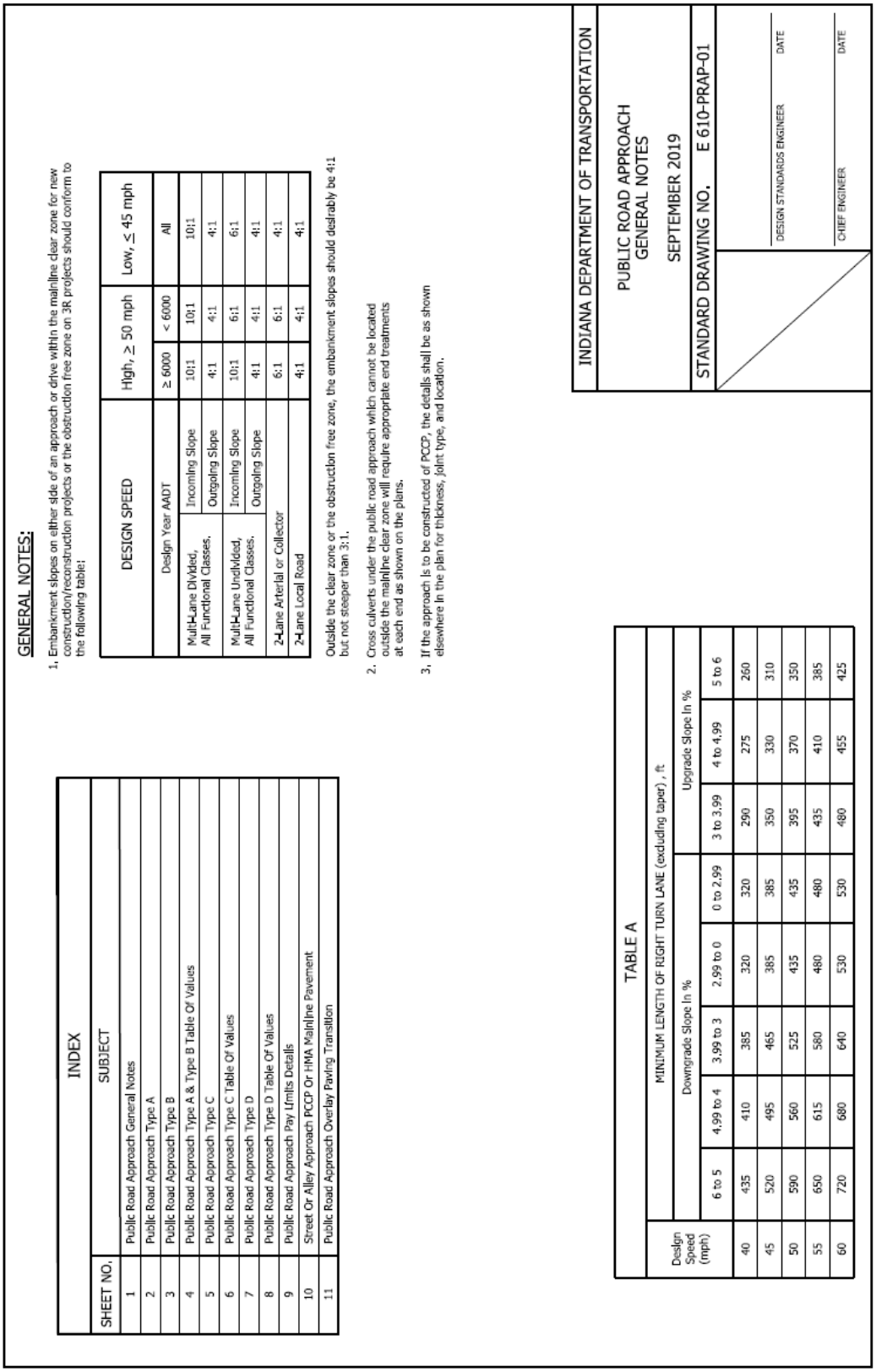
REVISION TO STANDARD DRAWINGS

E 610-PRAP-14 STREET APPROACH WITH PCCP OR HMA MAINLINE PAVEMENT (WITH MARKUPS)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-01 PUBLIC ROAD APPROACH GENERAL NOTES (DRAFT)



INDEX

SHEET NO.	SUBJECT
1	Public Road Approach General Notes
2	Public Road Approach Type A
3	Public Road Approach Type B
4	Public Road Approach Type A & Type B Table Of Values
5	Public Road Approach Type C
6	Public Road Approach Type C Table Of Values
7	Public Road Approach Type D
8	Public Road Approach Type D Table Of Values
9	Public Road Approach Pay Limits Details
10	Street Or Alley Approach PCCP Or HMA Mainline Pavement
11	Public Road Approach Overlay Paving Transition

GENERAL NOTES:

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

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

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

2. Cross culverts under the public road approach which cannot be located outside the mainline clear zone will require appropriate end treatments at each end as shown on the plans.

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

TABLE A

Design Speed (mph)	MINIMUM LENGTH OF RIGHT TURN LANE (excluding taper), ft.						
	Downgrade Slope In %			Upgrade Slope In %			
	6 to 5	4.99 to 4	3.99 to 3	2.99 to 0	0 to 2.99	3 to 3.99	4 to 4.99	5 to 6
40	435	410	385	320	320	290	275	260
45	520	495	465	385	385	350	330	310
50	590	560	525	435	435	395	370	350
55	650	615	580	480	480	435	410	385
60	720	680	640	530	530	480	455	425

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH GENERAL NOTES

SEPTEMBER 2019

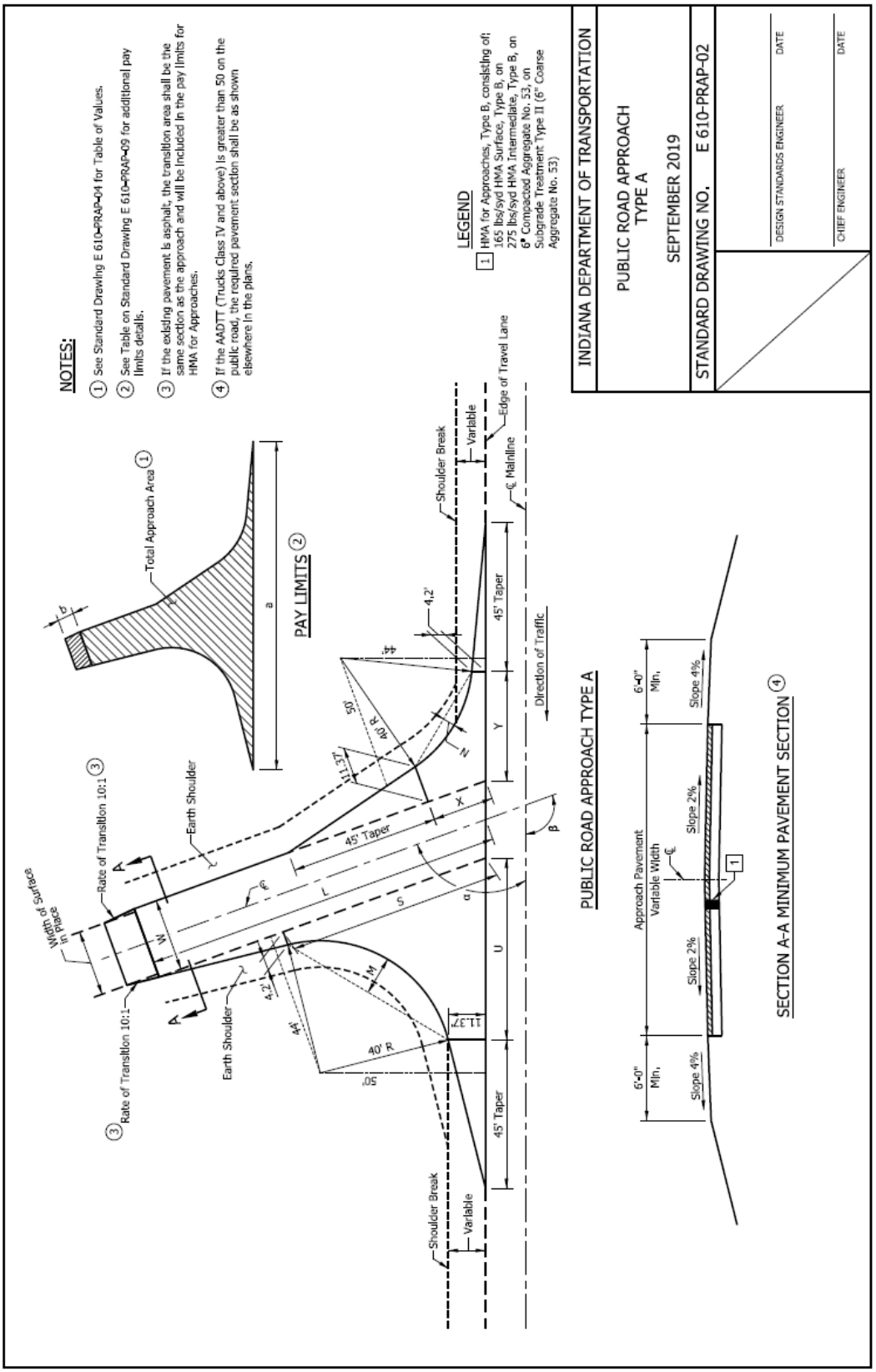
STANDARD DRAWING NO. E 610-PRAP-01

DESIGN STANDARDS ENGINEER DATE

CHIEF ENGINEER DATE

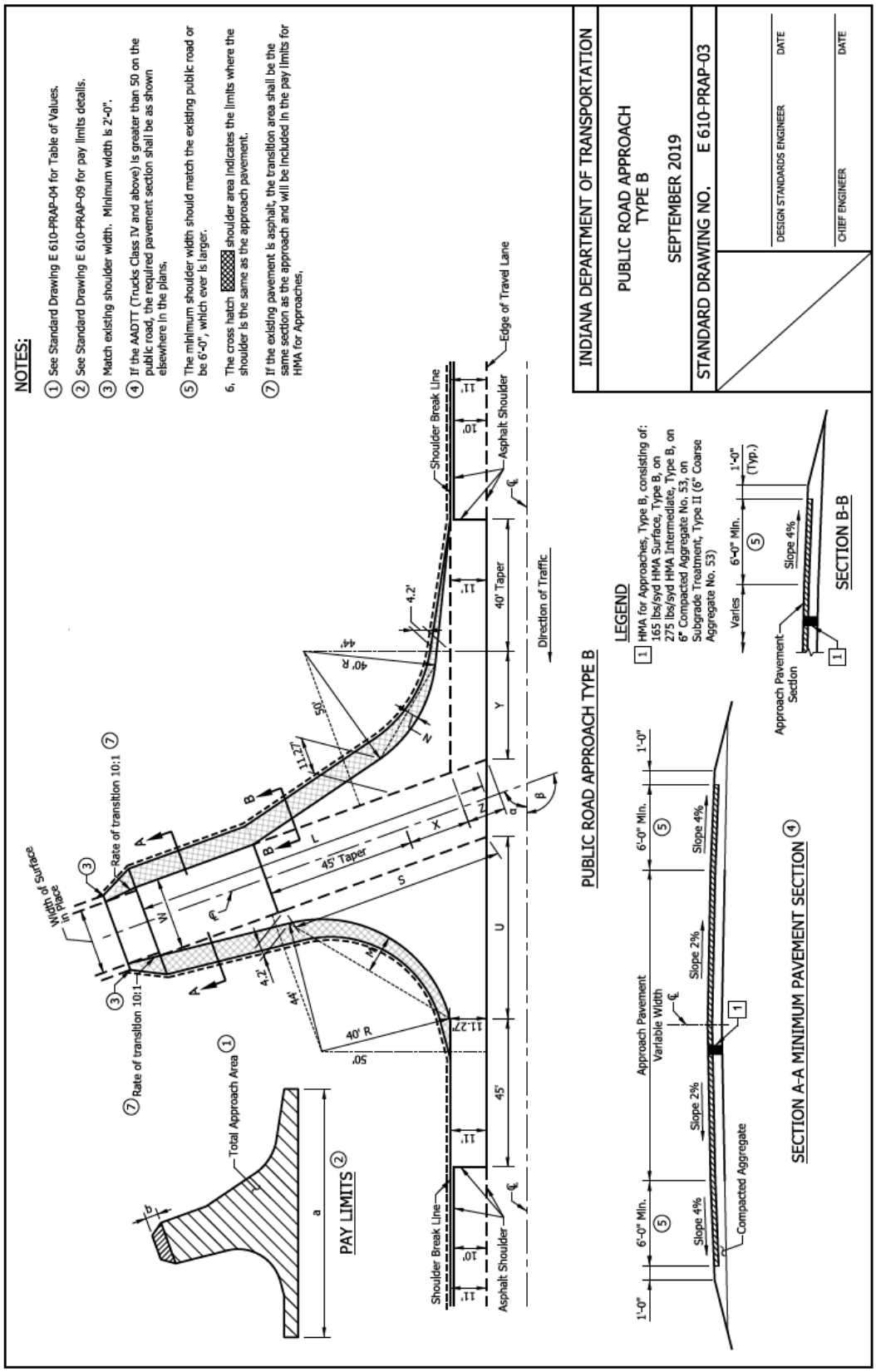
REVISION TO STANDARD DRAWINGS

E 610-PRAP-02 PUBLIC ROAD APPROACH TYPE A (DRAFT)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-03 PUBLIC ROAD APPROACH TYPE B (DRAFT)



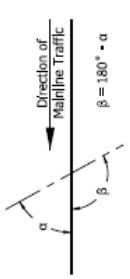
REVISION TO STANDARD DRAWINGS

E 610-PRAP-04 PUBLIC ROAD APPROACH TYPE A & TYPE B TABLE OF VALUES (DRAFT)

LEGEND:

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

β = INTERSECTION CONTROL ANGLE



NOTES:

1. See Standard Drawing E 610-PRAP-02 for Public Road Approach Type A.
2. See Standard Drawing E 610-PRAP-03 for Public Road Approach Type B.
3. If intersection control angle is less than 70° or greater than 110° a speedal design will be required.

β	L TYPE A W=20	L TYPE A W=24	L TYPE B W=20	L TYPE B W=22	L TYPE B W=24	Z	U	S	M	X	Y	N	TOTAL APPROACH AREA TYPE A W=20	TOTAL APPROACH AREA TYPE A W=22	TOTAL APPROACH AREA TYPE A W=24	TOTAL APPROACH AREA TYPE B W=20	TOTAL APPROACH AREA TYPE B W=22	TOTAL APPROACH AREA TYPE B W=24	β
(°)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(sys)	(sys)	(sys)	(sys)	(sys)	(sys)	(°)
110	108,87	109,23	109,60	108,87	109,23	109,60	11,71	55,02	65,23	11,66	18,63	33,20	3,72	531,19	556,20	584,87	645,05	670,14	695,38	110
109	107,48	107,82	108,17	107,48	107,82	108,17	11,63	53,75	64,04	11,42	19,32	33,74	3,86	524,90	549,63	574,51	639,55	664,28	689,15	109
108	106,12	106,45	106,77	106,12	106,45	106,77	11,57	52,51	62,88	11,19	20,02	34,28	4,02	518,88	543,25	567,78	634,32	658,70	683,22	108
107	104,80	105,10	105,41	104,80	105,10	105,41	11,50	51,30	61,74	10,94	20,72	34,84	4,17	513,11	537,15	561,32	629,37	653,40	677,37	107
106	103,50	103,79	104,48	103,50	103,79	104,08	11,44	50,11	60,64	10,70	21,44	35,40	4,33	507,60	531,30	555,13	624,67	648,37	672,20	106
105	102,24	102,51	102,77	102,24	102,51	102,77	11,39	48,95	59,56	10,46	22,16	35,98	4,49	502,33	525,70	549,20	620,23	643,61	667,10	105
104	101,00	101,25	101,50	101,00	101,25	101,50	11,34	47,81	58,51	10,23	22,88	36,56	4,65	497,30	520,35	543,52	616,04	639,10	662,26	104
103	99,79	100,02	100,25	99,79	100,02	100,25	11,29	46,70	57,48	9,99	23,62	37,16	4,81	492,50	515,24	538,06	612,10	634,83	657,68	103
102	98,60	98,81	99,02	98,60	98,81	99,02	11,25	45,81	56,48	9,76	24,36	37,77	4,98	487,92	510,35	532,88	608,39	630,82	653,34	102
101	97,44	97,63	97,83	97,44	97,63	97,83	11,21	44,54	55,49	9,54	25,10	38,39	5,15	483,57	505,69	527,91	604,91	627,04	649,25	101
100	96,30	96,47	96,65	96,30	96,47	96,65	11,17	43,50	54,54	9,31	25,86	39,02	5,35	479,42	501,26	523,16	601,66	623,49	645,40	100
99	95,18	95,34	95,50	95,18	95,34	95,50	11,14	42,47	53,60	9,09	26,63	39,66	5,50	475,49	497,03	518,64	598,63	620,17	641,78	99
98	94,09	94,23	94,37	94,09	94,23	94,37	11,11	41,46	52,68	8,87	27,41	40,31	5,68	471,77	493,02	514,34	595,83	617,08	638,39	98
97	93,10	93,13	93,26	93,01	93,13	93,26	11,08	40,47	51,78	8,65	28,19	40,98	5,86	468,25	489,22	510,24	593,24	614,21	635,23	97
96	91,96	92,06	92,17	91,96	92,06	92,17	11,06	39,50	50,90	8,44	28,99	41,66	6,04	464,93	485,62	506,36	590,86	611,56	632,29	96
95	90,92	91,01	91,10	90,92	91,01	91,10	11,04	38,64	50,04	8,22	29,79	42,35	6,22	461,80	482,21	502,68	588,70	609,12	629,58	95
94	89,90	89,97	90,04	89,90	89,97	90,04	11,03	37,60	49,20	8,01	30,61	43,05	6,41	458,87	479,02	499,20	586,74	606,89	627,07	94
93	88,90	88,96	89,01	88,90	88,96	89,01	11,02	36,68	48,38	7,80	31,44	43,77	6,60	456,12	476,01	495,91	584,99	604,88	624,79	93
92	87,92	87,96	87,99	87,92	87,96	87,99	11,01	35,77	47,57	7,60	32,28	44,50	6,80	453,57	473,19	492,83	583,45	603,07	622,71	92
91	86,96	86,97	86,99	88,96	88,94	88,93	11,00	34,88	46,78	7,39	33,14	45,24	6,99	451,20	470,56	489,94	586,57	606,29	626,01	91
90	86,00	86,00	86,00	90,00	90,00	90,00	11,00	34,00	46,00	7,19	34,00	46,00	7,19	449,01	468,12	487,23	589,85	609,85	629,85	90
89	85,07	85,05	85,04	91,06	91,07	91,09	11,00	33,14	45,24	6,99	34,88	46,78	7,39	447,01	465,87	484,72	593,33	613,61	633,90	89
88	84,15	84,12	84,08	92,13	92,16	92,20	11,01	32,28	44,50	6,80	35,77	47,57	7,60	445,18	463,80	482,40	597,03	617,58	638,16	88
87	83,24	83,19	83,14	93,22	93,27	93,33	11,02	31,44	43,77	6,60	36,68	48,38	7,80	443,54	461,91	480,26	600,93	621,77	642,64	87
86	83,30	83,37	83,44	94,33	94,40	94,47	11,03	30,61	43,05	6,41	37,60	49,20	8,01	444,20	462,79	481,60	605,04	626,18	647,34	86
85	84,42	84,51	84,59	95,46	95,55	95,64	11,04	29,79	42,35	6,22	38,64	50,04	8,22	447,35	466,32	485,34	609,37	630,80	652,27	85
84	85,55	85,65	85,76	96,61	96,72	96,82	11,06	28,99	41,66	6,04	39,50	50,90	8,44	450,69	469,96	489,27	613,92	635,65	657,42	84
83	86,70	86,82	86,94	97,78	97,90	98,03	11,08	28,19	40,98	5,86	40,47	51,78	8,65	454,22	473,79	493,41	618,70	640,72	662,81	83
82	87,87	88,01	88,15	98,97	99,11	99,26	11,11	27,41	40,31	5,68	41,46	52,68	8,87	457,95	477,82	497,75	623,70	646,03	668,43	82
81	89,05	89,21	89,37	100,19	100,35	100,51	11,14	26,63	39,66	5,50	42,47	53,60	9,09	461,88	482,05	502,30	628,93	651,58	674,30	81
80	90,26	90,44	90,61	101,43	101,61	101,78	11,17	25,86	39,02	5,35	43,50	54,54	9,31	466,00	486,49	507,06	634,40	657,37	680,42	80
79	91,49	91,68	91,88	102,69	102,89	103,08	11,21	25,10	38,39	5,15	44,54	55,49	9,54	470,34	491,15	512,04	640,11	663,40	686,78	79
78	92,74	92,95	93,16	103,96	104,20	104,41	11,25	24,36	37,77	4,98	45,61	56,48	9,76	474,89	496,02	517,24	646,07	669,69	693,41	78
77	94,01	94,24	94,47	105,30	105,53	105,76	11,29	23,62	37,16	4,81	46,70	57,48	9,99	479,66	501,11	522,67	652,78	676,24	700,31	77
76	95,31	95,56	95,81	106,64	106,89	107,14	11,34	22,88	36,56	4,65	47,81	58,51	10,23	484,65	506,44	528,34	658,75	683,06	707,48	76
75	96,63	96,90	97,17	108,02	108,29	108,55	11,39	22,16	35,98	4,49	48,95	59,56	10,46	489,87	511,99	534,24	665,50	690,16	714,94	75
74	97,98	98,26	98,55	109,42	109,71	110,00	11,44	21,44	35,40	4,33	50,11	60,64	10,70	495,32	517,79	540,39	672,52	697,54	722,68	74
73	99,36	99,66	99,97	110,86	111,16	111,47	11,50	20,72	34,84	4,17	51,30	61,74	10,94	501,01	523,84	546,80	679,82	705,21	730,72	73
72	100,76	101,08	101,41	112,33	112,65	112,98	11,57	20,02	34,28	4,02	52,51	62,88	11,18	506,96	530,14	553,47	687,42	713,18	739,08	72
71	102,20	102,54	102,88	113,83	114,17	114,52	11,63	19,32	33,74	3,86	53,75	64,04	11,42	513,16	536,71	560,42	695,32	721,46	747,75	71
70	103,66	104,03	104,39	115,37	115,73	116,10	11,71	18,63	33,20	3,72	55,02	65,23	11,66	519,62	543,55	567,64	703,54	730,07	756,76	70

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH
TYPE A & TYPE B
TABLE OF VALUES
SEPTEMBER 2019

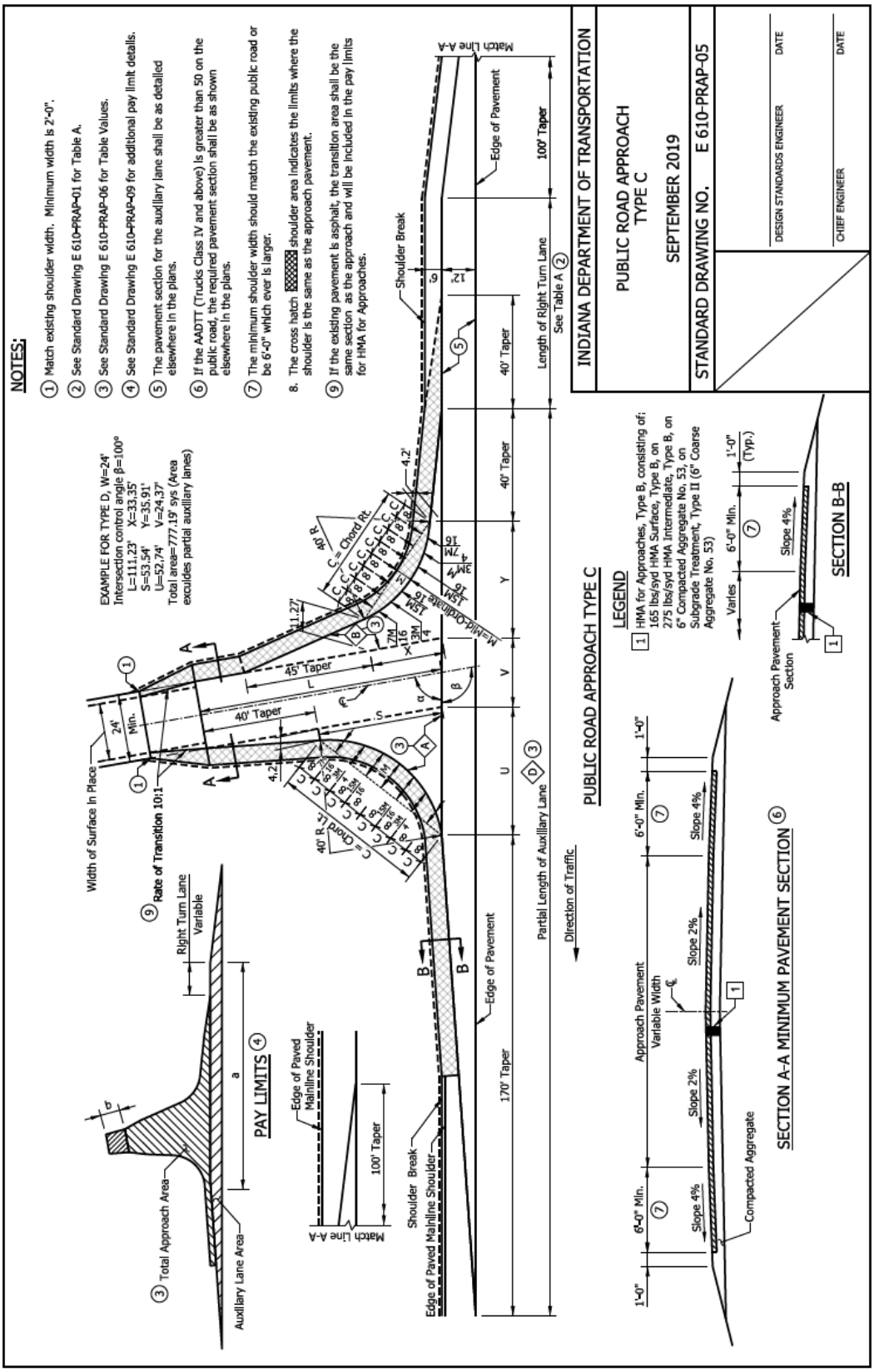
STANDARD DRAWING NO. E 610-PRAP-04

DESIGN STANDARDS ENGINEER DATE

CHIEF ENGINEER DATE

REVISION TO STANDARD DRAWINGS

E 610-PRAP-05 PUBLIC ROAD APPROACH TYPE C (DRAFT)



REVISION TO STANDARD DRAWINGS

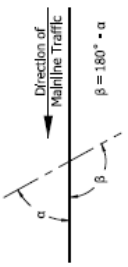
E 610-PRAP-06 PUBLIC ROAD APPROACH TYPE C TABLE OF VALUES (DRAFT)

β	L	S	U	X	Y	V	Shoulder Gap	Chord		M		Approach Areas			Auxiliary Lane Part. Area	β
								Lt.	Rt.	Lt.	Rt.	Ⓐ	Ⓑ	Total	Ⓓ	
(°)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(sys)	(sys)	(sys)	(sys)	(°)
110	99.29	94.29	58.51	18.86	33.10	25.54	327.15	61.27	33.78	14.28	3.74	115.63	86.31	466.70	322.87	110
109	99.74	93.17	57.44	19.56	33.64	25.38	326.46	60.82	34.41	14.01	3.89	112.05	88.00	465.28	321.94	109
108	95.97	52.07	56.39	20.26	34.18	25.24	325.81	60.36	35.04	13.75	4.04	108.60	89.73	454.24	321.08	108
107	94.66	50.99	55.37	20.96	34.74	25.10	325.21	59.90	35.66	13.49	4.19	105.27	91.50	449.20	320.27	107
106	93.38	49.94	54.38	21.68	35.30	24.97	324.65	59.44	36.29	13.23	4.35	102.05	93.32	444.39	319.53	106
105	92.13	48.92	53.41	22.40	35.88	24.85	324.13	58.97	36.91	12.97	4.51	98.94	95.17	439.79	318.84	105
104	90.90	47.91	52.46	23.31	36.46	24.73	323.66	58.49	37.52	12.71	4.67	95.89	97.11	435.44	318.21	104
103	89.70	46.93	51.53	23.86	37.06	24.63	323.22	58.01	38.14	12.46	4.84	93.00	99.00	431.22	317.63	103
102	88.51	45.96	50.63	24.60	37.66	24.54	322.83	57.53	38.75	12.21	5.01	91.44	101.00	427.22	317.11	102
101	87.35	45.02	49.74	25.35	38.28	24.45	322.48	57.04	39.36	11.96	5.18	87.44	103.11	423.56	316.63	101
100	86.21	44.09	48.88	26.11	38.91	24.37	322.16	56.55	39.97	11.71	5.35	84.89	105.22	419.89	316.21	100
99	85.09	43.19	48.03	26.88	39.55	24.30	321.88	56.06	40.57	11.46	5.53	82.33	107.33	416.56	315.85	99
98	83.98	42.30	47.20	27.66	40.21	24.24	321.65	55.56	41.17	11.22	5.70	79.89	109.56	413.33	315.53	98
97	82.90	41.42	46.39	28.45	40.87	24.18	321.44	55.05	41.77	10.98	5.88	77.44	111.78	410.33	315.26	97
96	81.83	40.57	45.60	29.24	41.55	24.13	321.28	54.54	42.36	10.74	6.07	75.22	114.11	407.56	315.04	96
95	80.77	39.72	44.82	30.05	42.24	24.09	321.15	54.03	42.95	10.50	6.25	73.00	116.44	404.89	314.87	95
94	79.74	38.90	44.06	30.87	42.94	24.06	321.06	53.51	43.54	10.27	6.44	70.78	118.89	402.33	314.75	94
93	78.71	38.08	43.32	31.70	43.66	24.03	321.01	52.99	44.12	10.03	6.63	68.67	121.44	400.11	314.68	93
92	77.12	37.28	42.58	32.54	44.39	24.01	320.99	52.47	44.70	9.80	6.83	66.67	124.00	396.33	314.65	92
91	78.19	36.50	41.87	33.40	45.13	24.00	321.01	51.94	45.28	9.58	7.02	64.78	126.67	399.89	314.67	91
90	79.26	35.72	41.16	34.26	45.89	24.00	321.06	51.41	45.86	9.35	7.22	62.89	129.44	403.56	314.75	90
89	80.35	34.96	40.48	35.14	46.67	24.00	321.15	50.87	46.43	9.13	7.42	61.00	132.22	407.44	314.86	89
88	81.46	34.21	39.80	36.04	47.46	24.01	321.27	50.33	46.99	8.91	7.63	59.22	135.11	411.56	315.03	88
87	82.58	33.47	39.13	36.95	48.27	24.03	321.44	49.78	47.56	8.69	7.83	57.44	138.00	415.67	315.25	87
86	83.71	32.75	38.48	37.87	49.09	24.06	321.63	49.24	48.11	8.47	8.04	55.78	141.00	420.11	315.51	86
85	84.86	32.03	37.84	38.81	49.93	24.09	321.87	48.68	48.67	8.26	8.25	54.22	144.11	424.67	315.82	85
84	86.03	31.32	37.21	39.77	50.79	24.13	322.14	48.13	49.22	8.05	8.47	52.67	147.44	429.44	316.18	84
83	87.22	30.62	36.60	40.74	51.67	24.18	322.45	47.57	49.77	7.84	8.68	51.11	150.67	434.44	316.60	83
82	88.42	29.93	35.99	41.73	53.48	24.30	322.79	47.00	50.32	7.63	8.90	49.67	154.11	439.47	317.06	82
81	89.64	29.26	35.39	42.74	53.48	24.30	323.18	46.44	50.86	7.43	9.12	48.22	157.56	444.78	317.57	81
80	90.89	28.58	34.81	43.77	54.42	24.37	323.60	45.87	51.39	7.23	9.35	46.78	161.22	450.33	318.13	80
79	92.15	27.92	34.23	44.82	55.38	24.45	324.06	45.29	51.93	7.03	9.57	45.56	164.89	456.11	318.75	79
78	93.44	27.27	33.67	45.89	56.36	24.54	324.56	44.72	52.46	6.83	9.80	44.22	168.67	462.11	319.42	78
77	94.75	26.62	33.11	46.98	57.37	24.63	325.11	44.14	52.98	6.64	10.03	42.89	172.67	468.22	320.14	77
76	96.09	25.98	32.56	48.09	58.39	24.73	325.69	43.55	53.50	6.45	10.26	41.78	176.78	474.67	320.92	76
75	97.45	25.35	32.02	49.23	59.45	24.85	326.32	42.97	54.02	6.26	10.50	40.56	180.89	481.22	321.76	75
74	98.83	24.72	31.50	50.39	60.52	24.97	326.99	42.37	54.53	6.07	10.73	39.44	185.22	488.11	322.65	74
73	100.25	24.10	30.98	51.58	61.63	25.10	327.70	41.78	55.04	5.89	10.97	38.22	189.67	495.22	323.60	73
72	101.70	23.49	30.46	52.80	62.76	25.24	328.46	41.18	55.55	5.71	11.21	37.11	194.22	502.56	324.61	72
71	103.17	22.88	29.96	54.04	63.92	25.38	329.27	40.58	56.05	5.53	11.46	36.11	199.00	510.18	325.69	71
70	104.68	22.28	29.46	55.31	65.12	25.54	330.12	39.98	56.54	5.35	11.70	35.11	203.89	518.11	326.83	70

LEGEND:

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

β = INTERSECTION CONTROL ANGLE



NOTES:

1. See Standard Drawing E 610-PRAP-05 for Public Road Approach Type C.
2. If intersection control angle is less than 70° or greater than 110° a special design will be required.

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH
TYPE C
TABLE OF VALUES
SEPTEMBER 2019

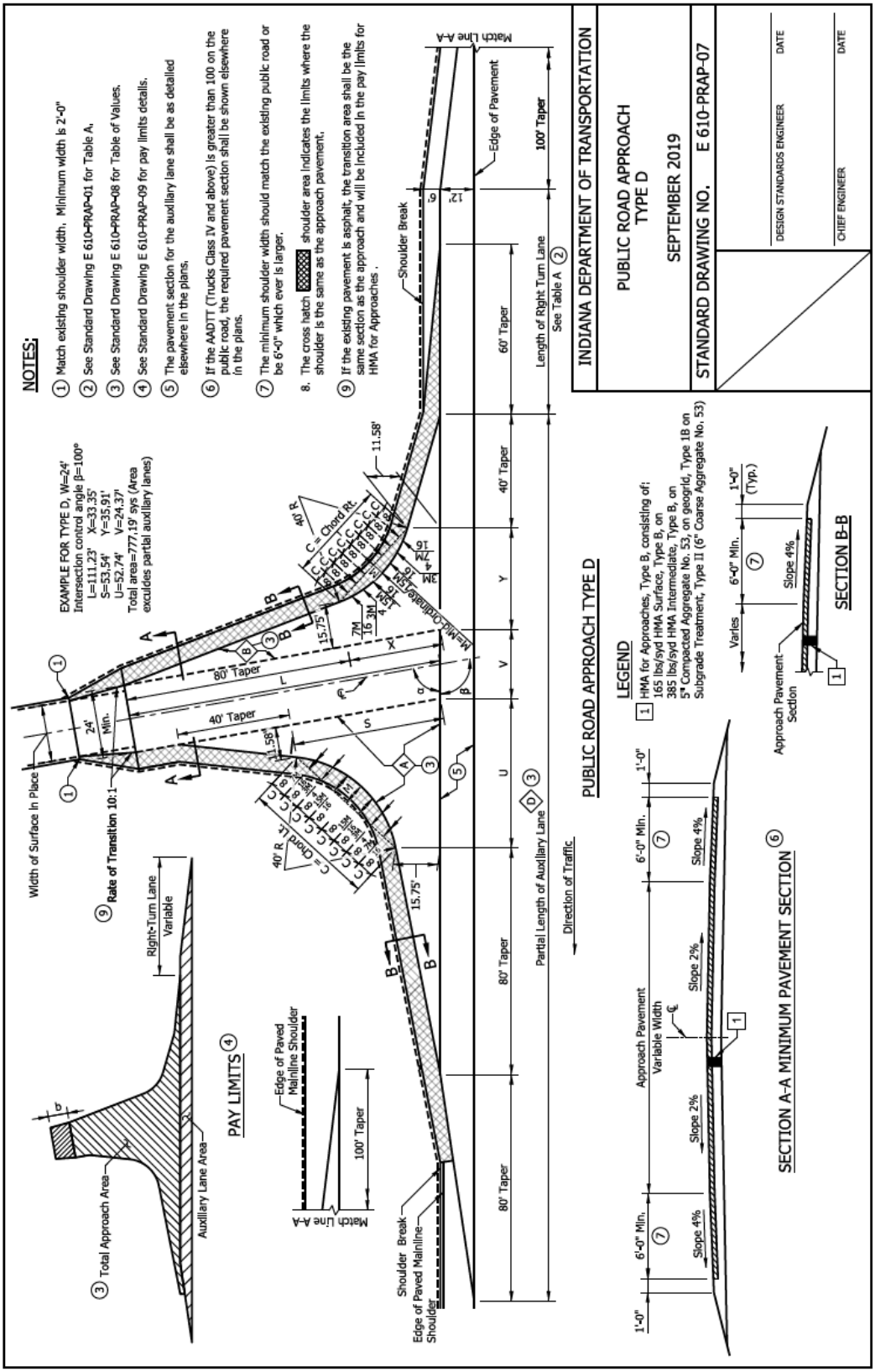
STANDARD DRAWING NO. E 610-PRAP-06

DESIGN STANDARDS ENGINEER DATE

CHIEF ENGINEER DATE

REVISION TO STANDARD DRAWINGS

E 610-PRAP-07 PUBLIC ROAD APPROACH TYPE D (DRAFT)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-08 PUBLIC ROAD APPROACH TYPE D TABLE OF VALUES (DRAFT)

β	L	S	U	X	Y	V	Shoulder Gap	Chord		M		Approach Areas			Auxiliary Lane Part. Area	β
								Lt.	Rt.	Lt.	Rt.	Ⓐ	Ⓑ	Total	Ⓓ	
(°)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(sys)	(sys)	(sys)	(sys)	(°)
110	109,97	65,61	65,50	25,46	29,21	25,54	320,25	52,66	29,14	9,98	2,75	335,88	174,50	803,64	373,67	110
109	108,40	64,26	64,09	26,22	29,83	25,38	319,31	52,34	29,79	9,75	2,88	329,40	176,97	795,42	372,41	109
108	106,85	62,98	62,72	26,97	30,46	25,24	318,41	51,81	30,43	9,52	3,01	323,11	179,49	787,55	371,22	108
107	105,35	61,68	61,37	27,74	31,11	25,10	317,57	51,27	31,08	9,30	3,14	317,01	182,07	780,00	370,10	107
106	105,08	60,43	60,06	28,52	31,76	24,97	316,78	50,73	31,72	9,07	3,28	311,08	184,70	775,99	369,04	106
105	106,08	59,22	58,77	29,30	32,42	24,85	316,04	50,19	32,36	8,85	3,42	305,33	187,38	775,60	368,06	105
104	107,10	58,03	57,52	30,09	33,10	24,73	315,35	49,65	33,00	8,63	3,56	299,74	190,12	775,45	367,13	104
103	108,12	56,87	56,28	30,89	33,78	24,63	314,70	49,10	33,63	8,42	3,71	294,31	192,92	775,54	366,26	103
102	109,15	55,74	55,08	31,70	34,48	24,54	314,10	48,54	34,26	8,21	3,85	289,03	195,78	775,87	365,46	102
101	110,18	54,63	53,90	32,52	35,19	24,45	313,54	47,99	34,89	8,00	4,01	283,89	198,70	776,42	364,72	101
100	111,23	53,54	52,74	33,35	35,91	24,37	313,02	47,43	35,52	7,79	4,16	278,90	201,68	777,19	364,03	100
99	112,28	52,48	51,61	34,18	36,65	24,30	312,55	46,86	36,14	7,58	4,32	274,04	204,73	778,19	363,40	99
98	113,35	51,45	50,49	35,03	37,39	24,24	312,12	46,30	36,77	7,38	4,47	269,31	207,85	779,42	362,83	98
97	114,42	50,43	49,40	35,89	38,15	24,18	311,73	45,72	37,38	7,18	4,64	264,70	211,04	780,86	362,31	97
96	115,51	49,44	48,33	36,77	38,93	24,13	311,39	45,15	38,00	6,98	4,80	260,21	214,31	782,53	361,85	96
95	116,60	48,46	47,27	37,65	39,71	24,09	311,08	44,57	38,61	6,78	4,97	255,84	217,65	784,42	361,44	95
94	117,71	47,51	46,24	38,55	40,52	24,06	310,82	43,99	39,22	6,59	5,14	251,58	221,01	786,54	361,09	94
93	118,83	46,57	45,22	39,46	41,33	24,03	310,59	43,41	39,83	6,40	5,31	247,43	224,56	788,87	360,79	93
92	119,96	45,66	44,22	40,38	42,17	24,01	310,40	42,82	40,43	6,21	5,48	243,38	228,15	791,43	360,54	92
91	121,11	44,76	43,24	41,32	43,01	24,00	310,26	42,23	41,03	6,03	5,66	239,43	231,82	794,21	360,34	91
90	122,27	43,88	42,27	42,27	43,88	24,00	310,15	41,63	41,63	5,84	5,84	235,58	235,58	797,21	360,20	90
89	123,45	43,01	41,32	43,24	44,76	24,00	310,08	41,03	42,23	5,66	6,03	231,82	239,43	800,44	360,11	89
88	124,64	42,17	40,38	44,22	45,66	24,01	310,06	40,43	42,82	5,48	6,21	228,15	243,38	803,90	360,07	88
87	125,85	41,33	39,46	45,22	46,57	24,03	310,07	39,83	43,41	5,31	6,40	224,56	247,38	807,60	360,09	87
86	127,08	40,52	38,55	46,24	47,51	24,06	310,12	39,22	43,99	5,14	6,59	221,06	251,56	811,52	360,16	86
85	128,32	39,71	37,65	47,27	48,46	24,09	310,21	38,61	44,57	4,97	6,78	217,65	255,84	815,69	360,28	85
84	129,59	38,93	36,77	48,33	49,44	24,13	310,34	38,00	45,15	4,80	6,98	214,31	260,21	820,09	360,45	84
83	130,87	38,15	35,89	49,40	50,43	24,18	310,51	37,38	45,72	4,64	7,18	211,04	264,70	824,74	360,67	83
82	132,18	37,39	35,03	50,49	51,45	24,24	310,72	36,77	46,30	4,47	7,38	207,85	269,31	829,64	360,95	82
81	133,51	36,65	34,18	51,61	52,48	24,30	310,97	36,14	46,86	4,32	7,58	204,73	274,04	834,79	361,29	81
80	134,86	35,91	33,35	52,74	53,54	24,37	311,26	35,52	47,43	4,16	7,79	201,68	278,90	840,20	361,68	80
79	136,23	35,19	32,52	53,90	54,63	24,45	311,59	34,89	47,99	4,01	8,00	198,70	283,89	845,87	362,12	79
78	137,63	34,48	31,70	55,08	55,74	24,54	311,97	34,26	48,54	3,85	8,21	195,78	289,03	851,82	362,63	78
77	139,06	33,78	30,89	56,28	56,87	24,63	312,39	33,63	49,10	3,71	8,42	192,92	294,31	858,04	363,19	77
76	140,51	33,10	30,09	57,52	58,03	24,73	312,85	33,00	49,65	3,56	8,63	190,12	299,74	864,55	363,80	76
75	141,99	32,42	29,30	58,77	59,22	24,85	313,36	32,36	50,19	3,42	8,85	187,38	305,33	871,35	364,48	75
74	143,50	31,76	28,52	60,06	60,43	24,97	313,92	31,72	50,73	3,28	9,07	184,70	311,08	878,44	365,22	74
73	145,04	31,11	27,74	61,37	61,68	25,10	313,92	31,08	51,27	3,14	9,30	182,07	317,01	885,85	366,02	73
72	146,61	30,46	26,97	62,72	62,96	25,24	315,17	30,43	51,81	3,01	9,52	179,49	323,11	893,57	366,89	72
71	148,22	29,83	26,22	64,09	64,26	25,38	315,86	29,79	52,34	2,88	9,75	176,97	329,40	901,63	367,82	71
70	149,87	29,21	25,46	65,50	65,61	25,54	316,61	29,14	52,86	2,75	9,99	174,50	335,88	910,02	368,81	70

LEGEND:

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

β = INTERSECTION CONTROL ANGLE

NOTES:

1. See Standard Drawing E 610-PRAP-07 for Public Road Approach Type D.
2. If intersection control angle is less than 70° or greater than 110° a special design will be required.

INDIANA DEPARTMENT OF TRANSPORTATION

PUBLIC ROAD APPROACH
TYPE D
TABLE OF VALUES
SEPTEMBER 2019

STANDARD DRAWING NO. E 610-PRAP-08

DESIGN STANDARDS ENGINEER DATE

CHIEF ENGINEER DATE

REVISION TO STANDARD DRAWINGS

E 610-PRAP-09 PUBLIC ROAD APPROACH PAY LIMIT DETAILS (DRAFT)

NOTES:

1. The pay limits shown hereon generally apply to Types A, B, C and D Public Road Approaches as shown on Standard Drawings E 610-PRAP-02, -03, -05 and -07 respectively.

(2) See Tables of Values on Standard Drawings E 610 PRAP-04, 06, and -08.

INDIANA DEPARTMENT OF TRANSPORTATION

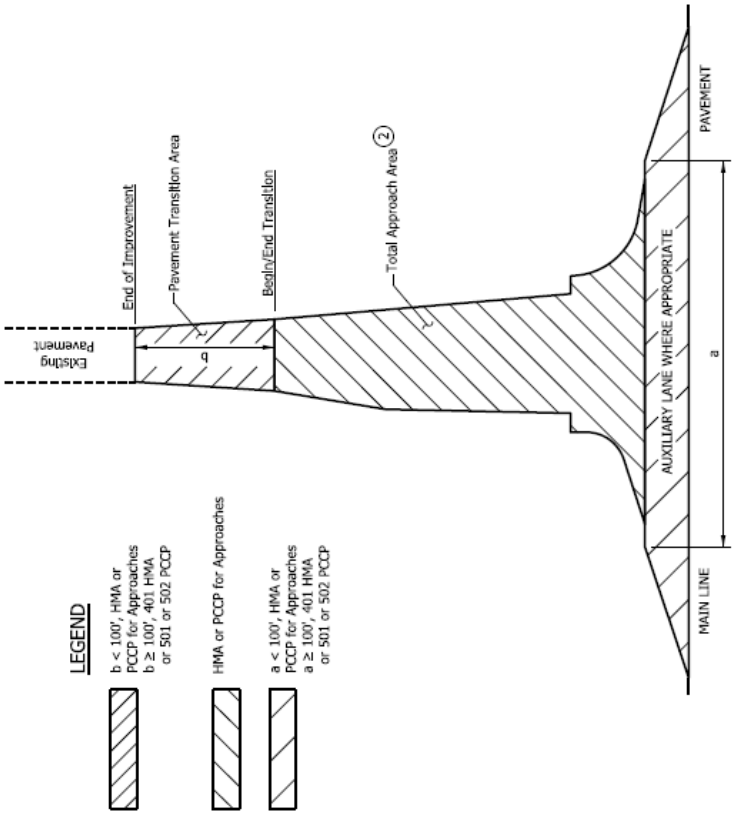
PUBLIC ROAD APPROACH
PAY LIMIT DETAILS

SEPTEMBER 2019

STANDARD DRAWING NO. E 610-PRAP-09

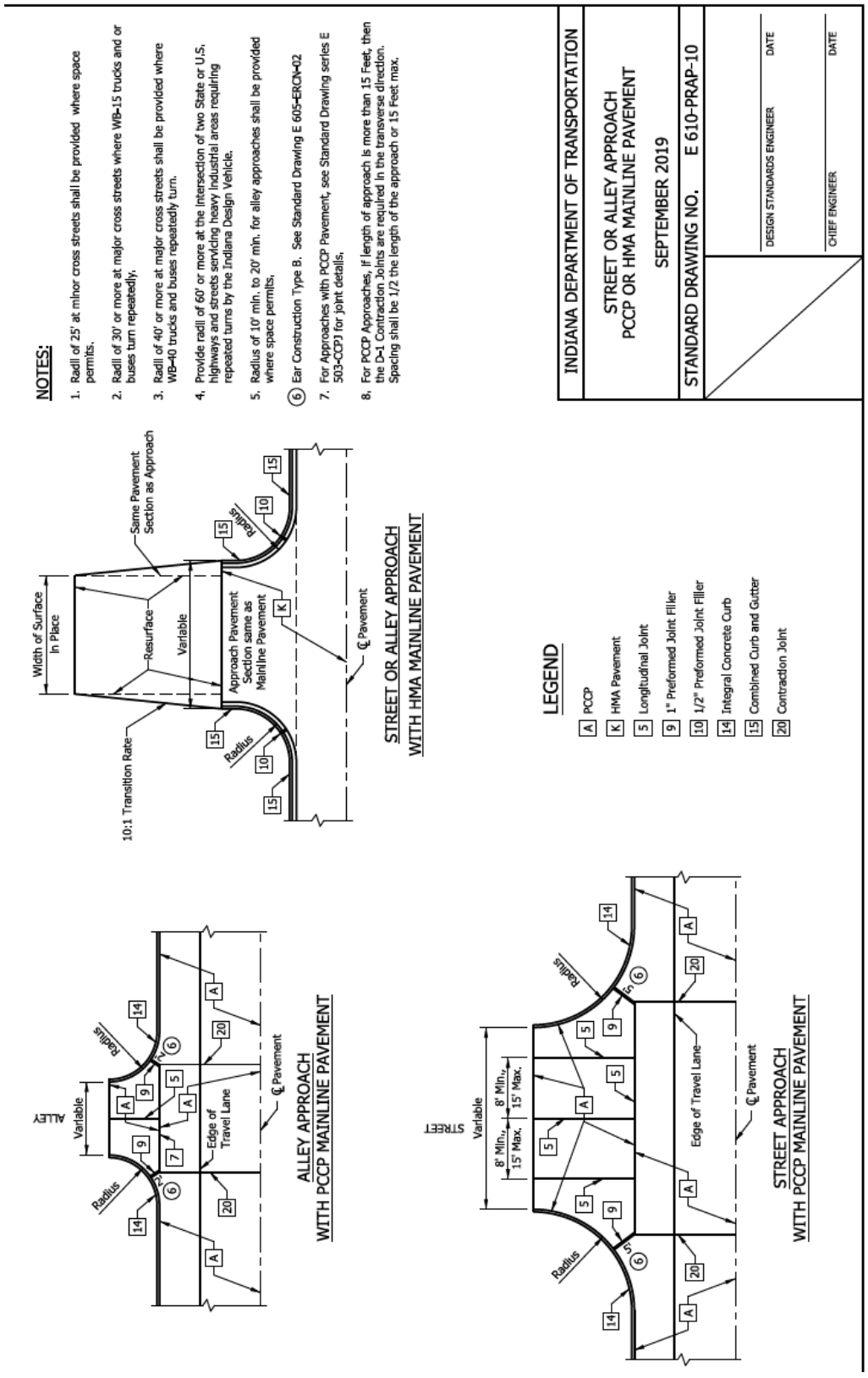
DESIGN STANDARDS ENGINEER DATE

CHIEF ENGINEER DATE



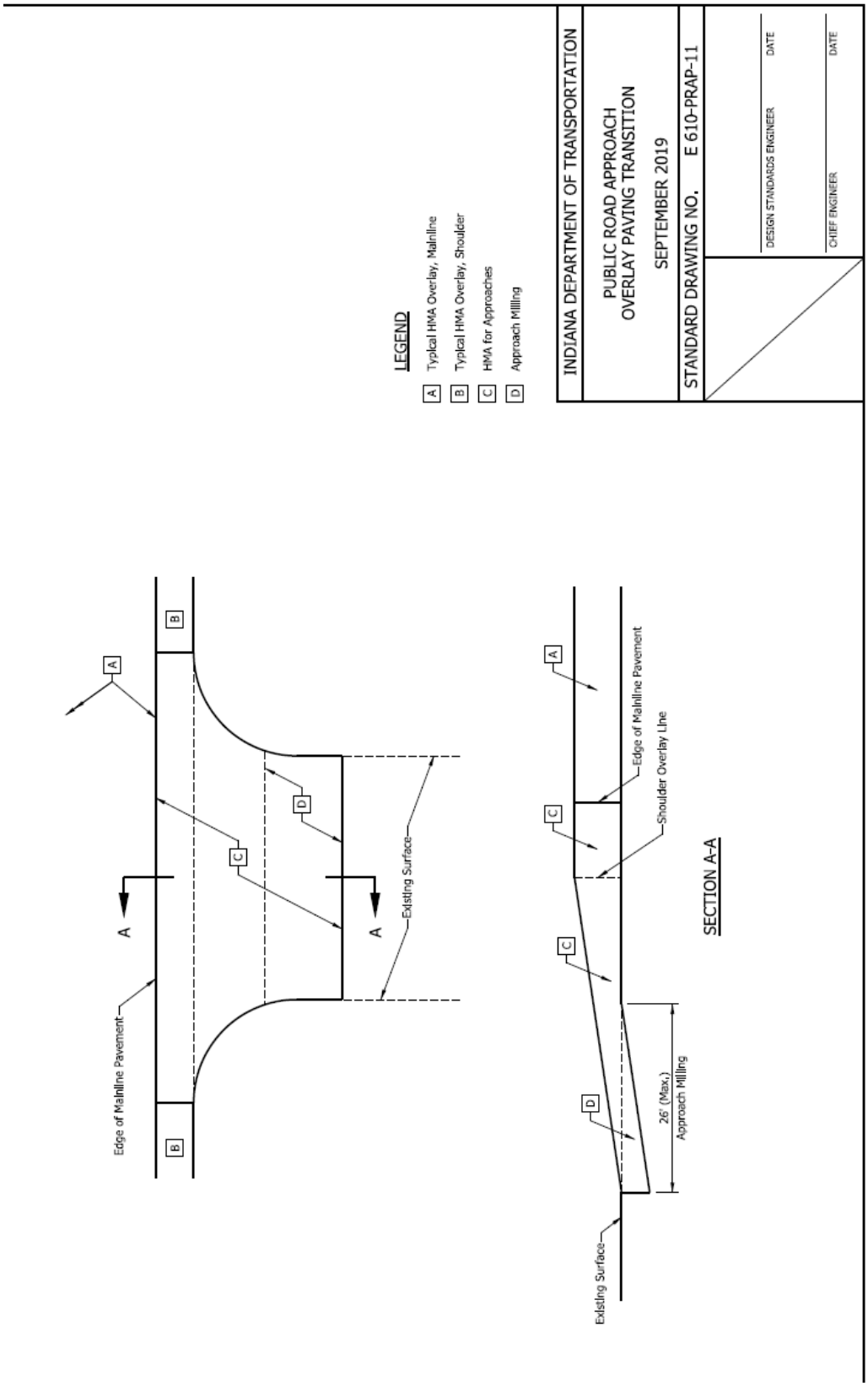
REVISION TO STANDARD DRAWINGS

E 610-PRAP-10 STREET OR VALLEY APPROACH PCCP OR HMA MAINLINE PAVEMENT (DRAFT)



REVISION TO STANDARD DRAWINGS

E 610-PRAP-11 PUBLIC ROAD APPROACH OVERLAY PAVING TRANSITION (DRAFT)



COMMENTS AND ACTION

E 610-PRAP (SERIES)

DISCUSSION:

Motion: Second: Ayes: Nays: FHWA Approval:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections referenced and/or affected: 610 begin pg. 435 Recurring Special Provision affected: NONE Standard Drawing affected: E 610-PRAP (series) Design Manual Sections affected: 46-1.05(02) and 46-1.05(03) (no revisions required) GIFE Sections cross-references: NONE	_____ 2020 Standard Specifications _____ Revise Pay Items List _____ Create RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Revise RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Standard Drawing Effective _____ Create RPD (No. _____) Effective _____ Letting _____ GIFE Update _____ SiteManager Update

Mr. Beeson
Date: 1/17/19

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Further clarification regarding last round of 401 specification edits. Test strips are not productive, specs aren't necessarily encouraging the right type of mix, pay calculations need to reflect quality being provided, cores required when not needed. A new design method to improve density needs to be implemented.

PROPOSED SOLUTION: Revise language for clarification. Remove test strip requirements, switch pay equations to look at Vbe instead of VMA, adjust PWL pay equations, remove excessive coring requirements, and implement Superpave 5 requirements.

APPLICABLE STANDARD SPECIFICATIONS: 401 and 402

APPLICABLE STANDARD DRAWINGS: N/A

APPLICABLE DESIGN MANUAL SECTION: N/A

APPLICABLE SECTION OF GIFE: N/A

APPLICABLE RECURRING SPECIAL PROVISIONS: RSP 401-R-661, RSP 402-R-662

PAY ITEMS AFFECTED: N/A

APPLICABLE SUB-COMMITTEE ENDORSEMENT: INDOT/APAI Steering Committee.

IMPACT ANALYSIS (attach report):

Submitted By: Matt Beeson

Title: State Materials Engineer

Organization: INDOT

Phone Number: 317-610-7251 x204

Date: 12/19/18

Mr. Beeson
Date: 1/17/19

STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS

REVISION TO STANDARD SPECIFICATIONS

IMPACT ANALYSIS REPORT CHECKLIST

Explain the business case as to why this item should be presented to the Standards Committee for approval. Answer the following questions with Yes, No or N/A.

Does this item appear in any other specification sections? N

Will approval of this item affect the Approved Materials List? N

Will this proposal improve:

Construction costs? Y

Construction time? N

Customer satisfaction? Y

Congestion/travel time? N

Ride quality? Y

Will this proposal reduce operational costs or maintenance effort? Y

Will this item improve safety:

For motorists? Y

For construction workers? Y

Will this proposal improve quality for:

Construction procedures/processes? Y

Asset preservation? Y

Design process? Y

Will this change provide the contractor more flexibility? Y

Will this proposal provide clarification for the Contractor and field personnel? Y

Can this item improve/reduce the number of potential change orders? Y

Is this proposal needed for compliance with:

Federal or State regulations? N

AASHTO or other design code? N

Is this item editorial? N

Provide any further information as to why this proposal should be placed on the Standards Committee meeting Agenda: This is a culmination of collaboration of INDOT and INDUSTRY partners over the last 6 months.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT
402-R-662 HOT MIX ASPHALT, HMA, PAVEMENT

(Note: Proposed changes shown highlighted gray.
This provision has been approved by the Standards Committee
on July 19, 2017 meeting to be incorporated into 2020 Standard Specifications)

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT

(Revised 01-31-18)

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 42, DELETE AND INSERT AS FOLLOWS:

The DMF shall state the ~~calibration factor, test temperature, and absorption factors to be used for the determination of binder content using the ignition oven in accordance with ITM 586, the~~ binder content ~~by extraction in accordance with ITM 571~~, the ΔPb determined in accordance with ITM 591 and a Mixture Adjustment Factor, MAF. The DMF shall state the source, type, and dosage rate of any stabilizing additives.

SECTION 401, BEGIN LINE 79, DELETE AND INSERT AS FOLLOWS:

Dust/Calculated Effective Binder Ratio shall be 0.6 to 1.4. The Dust/Calculated Effective Binder Ratio for 4.75 mm mixtures shall be ~~in accordance with AASHTO M 323~~*1.0 to 2.0*.

SECTION 401, BEGIN LINE 85, DELETE AND INSERT AS FOLLOWS:

AIR VOIDS AT OPTIMUM BINDER CONTENT								
	Dense Graded					Open Graded		
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	25.0 mm	19.0 mm	9.5 mm
Air Voids	~~4.0~~*5.0*%	~~4.0~~*5.0*%	~~4.0~~*5.0*%	~~4.0~~*5.0*%	5.0%	15.0% - 20.0%		10.0% - 15.0%

The design for dense graded mixtures shall have at least four points, including a minimum of two points above and one point below the optimum. A one point design may be used for open graded mixtures. The maximum specific gravity shall be mass determined in water in accordance with AASHTO T 209. The bulk specific gravity of the gyratory specimens shall be determined in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~*331*, if required, for dense graded ~~mixtures~~ and ~~AASHTO T 331 for~~ open graded mixtures.

The percent draindown of open graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305. Open graded mixtures may incorporate recycled materials and fibers. The recycled materials shall be in accordance with 401.06, and the fiber type and minimum dosage rate shall be in accordance with AASHTO M 325. The binder for open graded mixtures may have the upper temperature classification reduced by 6°C from the specified binder grade if fibers are incorporated into the mixture or if 3.0% reclaimed asphalt shingles by weight of the total mixture is used.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT
402-R-662 HOT MIX ASPHALT, HMA, PAVEMENT

The percent draindown of dense graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305. Dense graded mixture shall be tested for moisture susceptibility in accordance with AASHTO T 283 except that the loose mixture curing shall be replaced by mixture conditioning for 4 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 80%. The 6 in. mixture specimens shall be compacted in accordance with AASHTO T 312. If anti-stripping additives are added to the mixture to be in accordance with the minimum TSR requirements, the dosage rate shall be submitted with the DMF.

A PG binder grade or source change will not require a new mix design. If the upper temperature classification of the PG binder is lower than the original PG grade, a new TSR value is required.

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where $0.980 \leq MAF \leq 1.020$, then the MAF shall be considered to be 1.000. If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value. The MAF does not apply to OG mixtures.

Changes in the source or types of aggregates shall require a new DMF.

The mixture design compaction temperature for the specimens shall be 300 ± 9°F for dense graded mixtures and 260°F for open graded mixtures.

Design criteria for each mixture shall be based on the ESAL shown in the contract documents and shall be as follows:

GYRATORY COMPACTION EFFORT					
ESAL	N_{ini}*	N_{des}*	N_{max}*	Max. % Gmm @ N_{ini}	Max. % Gmm @ N_{max}
Dense Graded					
< 3,000,000	~~75~~ *75*	~~75~~*30*	~~115~~*40*	~~90.5~~*91.5*	~~98.0~~*97.0*
3,000,000 to < 10,000,000	~~86~~ *86*	~~100~~*50*	~~160~~*75*	~~89.0~~*91.5*	~~98.0~~*97.0*
≥ 10,000,000	~~86~~ *86*	~~100~~*50*	~~160~~*75*	~~89.0~~*91.5*	~~98.0~~*97.0*
Open Graded					
All ESAL	n/a	20	n/a	n/a	n/a
* N_{ini}, N_{des}, N_{max} - definitions are included in AASHTO R 35					

VOIDS IN MINERAL AGGREGATE, VMA, CRITERIA @ N_{des}	
Mixture Designation	Minimum VMA, %
4.75 mm	17.0
9.5 mm	~~15.0~~*16.0*

12.5 mm	~~14.0~~*15.0*
19.0 mm	~~13.0~~*14.0*
25.0 mm	~~12.0~~*13.0*
OG~~19.0 mm~~	n/a
~~OG25.0 mm~~	~~n/a~~

VOLUME OF EFFECTIVE BINDER, Vbe, CRITERIA @ N_{des}	
Mixture Designation	*Minimum Vbe, %*
4.75 mm	*12.0*
9.5 mm	*11.0*
12.5 mm	*10.0*
19.0 mm	*9.0*
25.0 mm	*8.0*
OG	*n/a*

VOIDS FILLED WITH ASPHALT, VFA, CRITERIA @ N_{des}	
ESAL	VFA, %
< 3,000,000	~~65–78~~*60-73*
3,000,000 to < 10,000,000	~~65–75~~*60-70*
≥ 10,000,000	~~65–75~~*60-70*

Notes:
1. For 9.5 mm mixtures, the specified VFA range shall be ~~73% to 76%~~*68% to 71%* for design traffic levels ≥ 3 million ESALs.
2. For 25.0 mm mixtures, the specified lower limit of the VFA shall be ~~67~~*62*% for design traffic levels < 0.3 million ESALs.
3. For 4.75 mm mixtures, the specified VFA range shall be 67% to 79%.
4. For OG~~9.5 mm, OG19.0 mm, OG25.0 mm~~ mixtures, VFA is not applicable.

401.06 Recycled Materials

Recycled materials may consist of reclaimed asphalt pavement, RAP, or reclaimed asphalt shingles, RAS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. Before entering the plant, RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve and RAS shall be processed so that 100% will pass the 3/8 in. (9.5 mm) sieve. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced.

RAP for the ESAL category 3 and 4 surface mixtures shall be *a fine RAP with* 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve. *The Contractor may request the use of coarse RAP in a category 4 surface mixture up to a maximum 20.0% by volume of material retained on the No. 4 (4.75 mm) sieve. The election to use coarse RAP in a category 4 surface mixture will void the allowed use of crushed stone and gravel coarse aggregate materials in accordance with 904.03(d). SMA RAP as defined in 410.06 shall not be used in any HMA mixture.*

SECTION 401, BEGIN LINE 180, DELETE AND INSERT AS FOLLOWS:

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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

MAXIMUM BINDER REPLACEMENT, %										
Mixture Category	Base and Intermediate							Surface		
	Dense Graded				Open Graded			Dense Graded		
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	25.0 mm	19.0 mm	*9.5 mm*	12.5 mm	9.5 mm	4.75 mm
2	25.0*				25.0*			25.0*		
3	25.0*				25.0*			25.0*		
4	25.0*				25.0*			25.0*		
* The contribution of RAS to any HMA mixture shall be ≤ 3.0% by total mass of mixture and ≤ 15.0% binder replacement.										

SECTION 401, BEGIN LINE 197, DELETE AND INSERT AS FOLLOWS:

401.09 Acceptance of Mixtures

Acceptance of mixtures for ~~VMA~~*Vbe* at N_{des}, and air voids at N_{des} for each lot will be based on tests performed by the Engineer for dense graded 9.5 mm, 12.5 mm, 19.0 mm and 25.0 mm mixtures with original contract pay item quantities greater than or equal to 300 t.

SECTION 401, BEGIN LINE 222, DELETE AND INSERT AS FOLLOWS:

Acceptance samples will be reduced to the appropriate size for testing in accordance with ITM 587. The binder content and gradation will be determined in accordance with ~~ITM 586 or~~ ITM 571 ~~as directed by the Engineer~~. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

The effective specific gravity, Gse, of the mixture will be determined in each sublot and reported from the acceptance sample testing.

The total aggregate bulk specific gravity, Gsb, value will be determined in accordance with ITM 597.

The air voids will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens and the MSG for the sublot. The VMA will be determined in accordance with AASHTO R 35 based on the average bulk specific gravity from two gyratory specimens, the percent aggregate in the mixture from the sublot and the BSG of the aggregate blend from the DMF as applicable. The gyratory pills will be prepared in accordance with AASHTO T 312.

The dust/calculated effective binder ratio and the volume of effective binder in the mixture will be determined and reported from the acceptance sample testing conducted in each sublot. The volume of effective binder will be the difference between VMA and air voids. The Contractor shall take action in accordance with ITM 583 to address a dust/calculated effective binder ratio ~~greater than 1.4~~*not in accordance with 401.05,* ~~or~~ a

volume of effective binder in the mixture below design minimums*, or a volume of effective binder in the mixture greater than 2.0% above design minimums.*

The bulk specific gravity of gyratory specimens for dense graded mixtures will be determined in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~*331*, if required, except samples are not required to be dried overnight. The bulk specific gravity of gyratory specimens for open graded mixtures~~, OG19.0 mm, OG25.0 mm~~ will be determined in accordance with AASHTO T 331.

SECTION 401, BEGIN LINE 260, DELETE AND INSERT AS FOLLOWS:

Air voids, binder content and ~~VMA~~*Vbe* values will be reported to the nearest 0.01%. Draindown test results will be rounded to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 285, INSERT AS FOLLOWS:

Samples shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the sublot for sampling. If an entire sublot falls within this area, test results from the previous sublot will be used for acceptance. If the previous sublot is not available, the subsequent sublot will be used for acceptance. *If previous or subsequent sublot results for a mixture accepted by 401.19(a) will be replicated for an entire lot, each sublot in that lot will be accepted by 401.19(b).*

SECTION 401, BEGIN LINE 360, DELETE AND INSERT AS FOLLOWS:

401.12 Process Control

The Engineer and Contractor will jointly review the operations to ensure compliance with the QCP. Continuous violations of compliance with the QCP will result in suspension of paving operations.

~~*A test strip in accordance with ITM 597 shall be required for each submitted DMF per calendar year for each dense graded 9.5 mm, 12.5 mm, 19.0 mm and 25.0 mm mixture with original contract pay item quantities greater than or equal to 5,000 t of base and intermediate or 3,000 t of surface. The test strip shall be constructed as part of the first 300 t of DMF production or the Engineer may allow the test strip construction to be located off the paving project if requested by the Contractor. Plate samples shall be obtained from the test strip in accordance with ITM 802 and ITM 580.*~~

~~*A maximum 10 business day production shutdown for the DMF shall accompany the completion of the test strip in order for the Contractor and Engineer to conduct mixture testing.*~~

401.13 Weather Limitations

HMA courses of less than 138 lb/sq yd shall be placed when the ambient temperature and the temperature of the surface on which it is to be placed is 45°F or above. No mixture shall be placed on a frozen subgrade.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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401.14 Spreading and Finishing

The mixture shall be placed upon an approved surface by means of laydown equipment in accordance with 409.03(c). Prior to paving, both the planned quantity and lay rate shall be adjusted by multiplying by the MAF. When mixture is produced from more than one DMF for a given pay item, the MAF will be applied to the applicable portion of the mixture for each. The temperature of each mixture at the time of spreading shall ~~not~~ be ~~more~~*less* than 315°F whenever PG 64-22 or PG 70-22 binders are used or not more than 325°F whenever PG 76-22 binder is used.

SECTION 401, BEGIN LINE 482, DELETE AND INSERT AS FOLLOWS:

Density of any random core location in these areas will be assigned a value of ~~92.0~~*94.0*% MSG and compaction shall be in accordance with 402.15.

SECTION 401, BEGIN LINE 504, DELETE AND INSERT AS FOLLOWS:

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform 6*.00 ± 0.25* in. diameter pavement sample. Coring shall be completed prior to the random location being covered by the next course.

~~Surface courses~~*All core locations will be marked and* shall be cored within two work days of placement. *A* d~~D~~amaged core shall be discarded and replaced with a core from a location selected by adding 1 ft to the longitudinal location of the damaged core using the same transverse offset.

The Contractor and the Engineer shall mark the core to define the course to be tested. If the core indicates a course thickness of less than two times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

Cores shall not be obtained from areas placed with paving equipment in accordance with 409.03(c)2 or 409.03(c)3. If a random location falls within this area, the Engineer will randomly select another location within the sublot for coring. If an entire sublot falls within this area, test results from the previous sublot will be used for acceptance. If the previous sublot is not available, the subsequent sublot will be used for acceptance.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring will be the responsibility of the Department. Subsequent core locations will be determined by subtracting 1 ft from the random location using the same transverse offset.

The density for the mixture will be expressed as the percentage of maximum specific gravity, % MSG, obtained by dividing the average bulk specific gravity by the maximum specific gravity for the sublot, times 100. Samples for the bulk specific gravity and maximum specific gravity will be dried in accordance with ITM 572. The Engineer

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT
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will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~*331*, if required. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209.

Within one work day of coring operations the Contractor shall clean, dry, and refill the core holes with HMA of similar or smaller size particles.

The Engineer's acceptance test results for each sublot will be available when the sublot testing is complete. Acceptance of the pavement for density (% MSG) will be reported to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

SECTION 401, BEGIN LINE 660, DELETE AND INSERT AS FOLLOWS:

401.19 Pay Factors

(a) Dense Graded Mixture ≥ One Lot

Pay factors, PF, are calculated for the air voids at N_{des}, ~~VMA~~*Vbe* at N_{des} and in-place density, % Gmm. The Percent Within Limits, PWL, for each lot will be determined in accordance with ITM 588. The appropriate pay factor for each property is calculated as follows:

Estimated PWL greater than 90:

$$PF = ((0.50 \times PWL) + 55.00)/100$$

Estimated PWL greater than ~~or equal to 50~~*70* and equal to or less than 90:

$$PF = ((0.40 \times PWL) + 64.00)/100$$

Estimated PWL greater than or equal to 50 and equal to or less than 70:

$$PF = ((0.\text{~~625~~}85 \times PWL) + \text{~~43.75~~}32.5)/100$$

If the Lot PWL for any one of the properties is less than 50 ~~or~~, a sublot has an air void content less than 1.0% or greater than 7.0%, *or a sublot has a volume of effective binder greater than 3.0% above design minimums,* the lot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.

Air voids, ~~VMA~~*Vbe*, and in-place density, % Gmm, PF values will be reported to the nearest 0.01. Rounding will be in accordance with 109.01(a).

A composite pay factor for each lot based on test results for mixture properties and density is determined by a weighted formula as follows:

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$$\text{Lot PF} = 0.30(PF_{VOIDS}) + 0.35(PF_{\sout{VMA}VBE}) + 0.35(PF_{DENSITY})$$

where:

Lot PF = Lot Composite Pay Factor for Mixture and Density
PF_{VOIDS} = Lot Pay Factor for Air Voids at N_{des}
$PF_{\sout{VMA}VBE}$ = Lot Pay Factor for ~~VMA~~*Vbe* at N_{des}
$PF_{DENSITY}$ = Lot Pay Factor for In-Place Density, %Gmm

The lot quality assurance adjustment for mixture properties and density is calculated as follows:

$$q = L \times U \times (\text{Lot PF} - 1.00)/MAF$$

where:

q = quality assurance adjustment for mixture properties and density of the lot
L = Lot quantity
U = Unit price for the material, $/ton
Lot PF = Lot Pay Factor

Lot test results for the air voids at Ndes, ~~VMA~~*Vbe* at Ndes, and density will be used to determine the Lot Pay Factors.

The specification limits for the air voids at N_{des}, ~~VMA~~*Vbe* at N_{des}, and density will be as follows:

SPECIFICATION LIMITS		
MIXTURE		
	LSL*	USL**
Air Voids at N_{des}, %	~~2.60~~*3.60*	~~5.40~~*6.40*
~~Voids In Mineral Aggregate~~ *Volume of Effective Binder* at N_{des}, %	Spec	Spec + 2.~~00~~*50*
DENSITY		
	LSL*	USL**
Roadway Core Density (% Gmm), %	~~91.00~~ *93.00*	n/a
* LSL, Lower Specification Limit ** USL, Upper Specification Limit		

(b) Dense Graded Mixture < One Lot and Open Graded Mixture

A composite pay factor for each sublot based on test results for mixture properties and density is determined in a weighted formula as follows:

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT
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Dense Graded Mixture:

$$SCPF = 0.30(PF_{VOIDS}) + 0.35(PF_{\sout{VMA}VBE}) + 0.35(PF_{DENSITY})$$

Open Graded Mixture:

$$SCPF = 0.20(PF_{BINDER}) + 0.35(PF_{VOIDS}) + 0.45$$

where:

SCPF = Sublot Composite Pay Factor for Mixture and Density
PF_{BINDER} = Sublot Pay Factor for Binder Content
PF_{VOIDS} = Sublot Pay Factor for Air Voids at N_{des}
$PF_{\sout{VMA}VBE}$ = Sublot Pay Factor for ~~VMA~~*Vbe* at N_{des}
$PF_{DENSITY}$ = Sublot Pay Factor for Density

If the SCPF for a sublot is less than 0.85 *or the volume of effective binder is greater than 3.0% above design minimums,* the ~~Office of Materials Management will evaluate the pavement. If the Contractor is not required to remove the mixture, quality assurance adjustments of the lot will be assessed or other corrective actions taken as determined by the Office of Materials Management~~*sublot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03*.

SECTION 401, BEGIN LINE 756, DELETE AND INSERT AS FOLLOWS:

~~VMA~~*Vbe*		
Dense Graded	~~Open Graded~~	Pay Factor
Deviation from Spec Minimum	~~Deviation from Spec Minimum~~	
> + ~~2.5~~ *3.0*		Submitted to the Office of Materials Management*
~~>~~ ≥ + ~~2.0~~ *2.5* and ≤ + ~~2.5~~ *3.0*		~~0.25~~*1.00 minus 0.05 for each 0.1% over +2.5%*
~~>~~ ≥ + ~~1.5~~ *2.0* and ≤ < + ~~2.0~~ *2.5*		~~0.65~~*1.05 minus 0.01 for each 0.1% over +2.0%*
> + 0.5 and ≤ < + ~~1.5~~ *2.0*		1.05
≥ 0.0 and ≤ + 0.5	~~All~~	~~1.00~~*1.05 minus 0.01 for each 0.1% under +0.5%*
≥ ~~-0.5~~ - *2.0* and < 0.0		~~0.85~~*1.00 minus 0.05 for each 0.1% under 0.0%*
~~≥ - 1.0 and < - 0.5~~		~~0.65~~
~~≥ - 1.5 and < - 1.0~~		~~0.45~~
~~≥ - 2.0 and < - 1.5~~		~~0.25~~
~~≥ - 2.5 and < - 2.0~~		~~0.00~~

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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< ~~2.5~~ *2.0*		Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.		

AIR VOIDS		
Dense Graded	Open Graded	Pay Factor
Deviation from DMF (± %)	Deviation** ~~from~~ ~~DMF~~ (± %)	
≤ 0.5	≤ ~~1~~*3*.0	1.05
> 0.5 and ≤ 1.0	> ~~1~~*3*.0 and ≤ ~~3~~*4*.0	1.00
1.1	~~3~~*4*.1	0.98
1.2	~~3~~*4*.2	0.96
1.3	~~3~~*4*.3	0.94
1.4	~~3~~*4*.4	0.92
1.5	~~3~~*4*.5	0.90
1.6	~~3~~*4*.6	0.84
1.7	~~3~~*4*.7	0.78
1.8	~~3~~*4*.8	0.72
1.9	~~3~~*4*.9	0.66
2.0	~~4~~*5*.0	0.60
> 2.0	> ~~4~~*5*.0	Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03. *** Deviation shall be from 17.5% for OG25.0 and OG19.0 mm mixtures and shall be from 12.5% for OG9.5mm mixtures.*		

For mixtures produced during a plant's adjustment period, pay factors based on the DMF with the above tolerances will be used to compute quality assurance adjustments.

Sublot test results for density will be assigned pay factors in accordance with the following:

DENSITY	
Percentages are based on %MSG	Pay Factors, %
Dense Graded	
≥ ~~97.0~~*98.0*	Submitted to the Office of Materials Management*
97.0 – 97.9	*1.00*
~~95.6 - 96.9~~ *96.6 - 96.9*	1.05 - 0.01 for each 0.1% above ~~95.5~~*96.5*
~~94.0 - 95.5~~ *95.0 - 96.5*	1.05
~~93.1 - 93.9~~ *94.1 - 94.9*	1.00 + 0.005 for each 0.1% above ~~93.0~~*94.0*
~~92.0 - 93.0~~ *93.0 - 94.0*	1.00
~~91.0 - 91.9~~*92.0 - 92.9*	1.00 - 0.005 for each 0.1% below ~~92.0~~*93.0*

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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~~90.0 - 90.9~~*91.0 - 91.9*	0.95 - 0.010 for each 0.1% below ~~91.0~~*92.0*
~~89.0 - 89.9~~*90.0 - 90.9*	0.85 - 0.030 for each 0.1% below ~~90.0~~*91.0*
≤ ~~88.9~~*89.9*	Submitted to the Office of Materials Management*
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.	

SECTION 401, BEGIN LINE 826, DELETE AND INSERT AS FOLLOWS:

The Contractor may appeal an individual sublot for the binder content, the MSG, the BSG of the gyratory specimens or the BSG of the density cores when the QC results are greater than one standard deviation from the acceptance test results as follows: 0.25 for binder content, 0.010 for the MSG and 0.010 for ~~both~~ the BSG of the gyratory specimens and *0.020 for the BSG of* the density cores. *Upon request from the Contractor, the BSG of the density core will be exempted from the individual sublot appeal if both the QC and QA results show a %MSG for the density greater than or equal to 93.0%.*

SECTION 401, BEGIN LINE 862, DELETE AND INSERT AS FOLLOWS:

(c) Binder Content

The backup binder content sample will be prepared and tested in accordance with ~~the test method that was used for acceptance or as directed by the Engineer~~*ITM 571*.

(d) BSG of the Density Core

Additional cores shall be taken within seven calendar days unless otherwise directed. Additional core locations will be determined by adding 1 ft longitudinally of the cores tested using the same transverse offset. The appeal density cores will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 166, Method A or AASHTO T ~~275~~*331*, if required.

SECTION 401, BEGIN LINE 940, DELETE AND INSERT AS FOLLOWS:

If QC/QA-HMA ~~intermediate~~*19.0 mm* over QC/QA-HMA ~~base~~*25.0 mm* mixtures are specified, QC/QA-HMA ~~intermediate~~*19.0 mm* mixture may be considered as a substitute for the QC/QA-HMA ~~intermediate~~*19.0 mm* and QC/QA-HMA ~~base~~*25.0 mm* mixtures upon a written request by the Contractor. The request for the substitution shall be prepared in advance of the work. A computation will be made in order to obtain a unit price for the QC/QA-HMA ~~intermediate~~*19.0 mm* mixture. The quantity and amount for QC/QA-HMA ~~intermediate~~*19.0 mm* mixture shall equal the sum of the contract quantities and amounts shown for QC/QA-HMA ~~intermediate~~*19.0 mm* and QC/QA-HMA ~~base~~*25.0 mm* mixtures. The unit price for QC/QA-HMA ~~intermediate~~*19.0 mm* mixture shall be equal to the sum of contract amounts divided by the sum of contract quantities. Payment for the QC/QA-HMA ~~intermediate~~*19.0 mm* mixture will be made at the unit price per ton for QC/QA-HMA ~~intermediate~~*19.0 mm* mixture. No payment will be made for additional work or costs which may result due to this change.

REVISION TO STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

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(Note: Proposed changes shown highlighted gray.
This provision has been approved by the Standards Committee
on July 19, 2017 meeting to be incorporated into 2020 Standard Specifications)

402-R-662 HOT MIX ASPHALT, HMA, PAVEMENT

(Adopted 07-19-17)

The Standard Specifications are revised as follows:

SECTION 402, BEGIN LINE 91, DELETE AS FOLLOWS:

A DMF shall be prepared in accordance with the above table and submitted in a format acceptable to the Engineer one week prior to use. The DMF shall state the ~~calibration factor and test temperature to be used for the determination of~~ binder content ~~using ITM 586 or ITM 571~~.

SECTION 402, BEGIN LINE 149, DELETE AND INSERT AS FOLLOWS:

~~Compacted aggregate bases and~~ ~~r~~*R*ubblized *concrete pavements* ~~bases~~ shall be primed in accordance with 405. PCCP, milled asphalt surfaces, and asphalt surfaces shall be tacked in accordance with 406. Contact surfaces of curbing, gutters, manholes, and other structures shall be tacked in accordance with 406.

SECTION 402, BEGIN LINE 178, DELETE AND INSERT AS FOLLOWS:

The temperature of each mixture at the time of spreading shall ~~not~~ be ~~more~~*less* than 315°F whenever PG 64-22 or PG 70-22 binders are used.

SECTION 402, BEGIN LINE 304, INSERT AS FOLLOWS:

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform *6.00 ± 0.25* in. diameter pavement sample. Coring shall be completed prior to the random location being covered. The final HMA course shall be cored within one work day of placement. Damaged cores shall be discarded and replaced with a core from a location selected by adding 1 ft to the longitudinal location of the damaged core using the same transverse offset.

SECTION 402, BEGIN LINE 330, DELETE AND INSERT AS FOLLOWS:

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166 Method A or AASHTO T ~~275~~*331*, if required. The maximum specific gravity will be mass determined in water in accordance with AASHTO T 209. Density shall not be less than ~~92.0~~*93.0*%.

Within one work day of coring operations, the Contractor shall clean, dry, refill, and compact the core holes with suitable HMA of similar or smaller size particles.

COMMENTS AND ACTION

401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT
402-R-662 HOT MIX ASPHALT, HMA, PAVEMENT

DISCUSSION:

Motion: Second: Ayes: Nays: FHWA Approval:	Action: _____ Passed as Submitted _____ Passed as Revised _____ Withdrawn
Standard Specifications Sections referenced and/or affected: 401 begin pg 257; 402 begin pg 283. Recurring Special Provision affected: 401-R-661 QC/QA HOT MIX ASPHALT, HMA, PAVEMENT 402-R-662 HOT MIX ASPHALT, HMA, PAVEMENT Standard Drawing affected: NONE Design Manual Sections affected: NONE GIFE Sections cross-references: NONE	_____ 2020 Standard Specifications _____ Revise Pay Items List _____ Create RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Revise RSP (No._____) Effective _____ Letting RSP Sunset Date: _____ Standard Drawing Effective _____ Create RPD (No. _____) Effective _____ Letting _____ GIFE Update _____ SiteManager Update