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ATTACHMENT 1-1

UNIQUE SPECIAL PROVISIONS:

General Scope of Work

A. Progress Meetings 1
B. Coordination with Adjacent Projects 2

PROGRESS MEETINGS

Weekly progress meetings shall be held at the project field office, or other mutually agreed upon location. The Design-Build Contractor shall document the Progress Meetings with meeting minutes and distributed to INDOT within three days after the Progress Meetings.

The Design-Build Contractor shall provide a six week look-ahead schedule at the progress meetings, including the number of Work crews, Work hours, delineation of day time and night time Work and the specific portions of the Work to be performed during the six week period. The Design-Build Contractor shall also discuss the status of the overall project schedule, including critical operations and potential problems. Design-Build Contractor shall provide a Progress Report to INDOT documenting the design and construction progress on a monthly basis.

COORDINATION WITH ADJACENT PROJECTS

The Design-Build Contractor shall coordinate all final design, drainage, maintenance of traffic, incident management, and construction activities with the following projects in accordance with Standard Specification 105.07:

Contract B-28990-Currently Under Construction

1. On I-65 NB & SB over Norfolk Southern Railroad, 3.67 miles north of SR 10; On I-65 NB & SB over Dehann Ditch, 0.73 miles north of CR 1300N

2. Original completion date 10/1/16; intermediate date 7/30/16

Contract R-35151 - Scheduled to let 7/13/16: Pipe lining 1.26 miles north of SR 2

Contract B-39158 (DES 1600012) - Scheduled to let 9/13/17: Pipe liner 2.11 miles south of SR 2

Contract B-35145 (LPA DES 1296986) – Scheduled to let 1/18/18: Bridge replacement on 101st Avenue over I-65, 2.5 miles south of US 30

Contract B-36671 - Scheduled to let 1/18/18: Bridge deck replacement on 153rd Avenue over I-65

Other - Department maintenance contracts in the project area.
The following contracts are expected to be let in the vicinity of the project and may impact TMP:

Contract R-33974 (DES 1172261) - Scheduled to let 7/13/16: Pipe lining 1.01 miles south of SR 10

Contract RS-38403 - Scheduled to let 4/6/16: HMA overlay from 2.9 miles north of SR 14 to 0.56 mi south of SR 10

Contract R-36016 - Scheduled to let 2/3/16: CPR on I-65 from US 30 to I-80/94 (Lake county)

Contract R-33941 – Scheduled to let 11/16/16: Pipe liner 0.41 miles south of SR 10 (STR # 65-37-229.15)

Contract B-35290 – Scheduled to let 1/19/17: I-65 Bridge deck overlay SBL at Stover Main Ditch 2.99 miles south of SR 10

Other – Department maintenance contracts
Information on these projects is available on the contract letting page and the 18-month letting list on INDOT website at:

http://www.in.gov/indot/div/lettings/18MonthsConstLettingDetails_Ext.pdf.

The Design-Build Contractor is required to become fully informed of the conditions relating to construction of this and any other contracts under

which the Work will be or is now being performed, and the Design-Build Contractor shall employ, as far as possible, such methods and means in carrying out of work as will not cause any interruption or interference with any other contractor or agency.

The Design-Build Contractor shall coordinate access to their job site with the other contractor(s) as other contractors will be required. The Design-Build Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly integrate, incorporate, and/or coordinate its Work with theirs. The Design-Build Contractor shall take due account of all such Work and shall arrange its methods of operation and storage of materials and equipment so as to cause a minimum of interferences with the Work to be performed by other contractors, utilities, or any public authority.

If any part of the Design-Build Contractor's Work depends on proper execution or results on the Work of any other contractor, the Design-Build Contractor shall promptly report to the Engineer any defect in Work by another contractor which renders it unsuitable for such proper execution and results. The Design-Build Contractor's failure to inspect and report such defects shall constitute an acceptance of the other contractor's Work as fit and proper for the integration or incorporation of its Work, except as to defects which may develop in the other contractor's Work after the execution of the Design-Build Contractor's Work.

Wherever Work being done by other contractors is in conflict, the respective rights of the various interests involved shall be established by the Engineer, in order to secure the completion of the various portions of the Work in general harmony.

The Contractor shall properly coordinate and expedite its Work in such a manner as to cause the least amount of conflict and interference between its operation and those of all others affected by its operations. Any or all damages or claims resulting from the improper or insufficient notification of all others affected by its operations shall be the responsibility of the Design-Build Contractor. Design-Build Contractor coordination and cooperation shall include, but is not limited to the following:

1. Transportation of construction materials through an adjacent Work zone

2. Construction activities to adjacent construction contracts

3. Maintenance of traffic operations along I-65

4. Placement of temporary erosion control items

No claims for additional compensation or adjustments will be allowed on account of delay or failure of others to complete the above Work as anticipated.

ATTACHMENT 3-1
APPLICABLE STANDARDS

3-1.1 Introduction

Design-Build Contractor shall design and construct the Work in accordance with the relevant requirements of the Project Standards listed in Table 3-1. In some instances, only specific sections of the referenced standard apply, as specified in these Technical Provisions. Section 1.3.4 of the PPA provides requirements regarding irreconcilable conflicts, ambiguities or inconsistencies among the Project Standards.

In accordance with PPA Section 2.1.2.5, Design-Build Contractor shall use the most current version of each standard or reference listed in Table 3-1 as of the Setting Date, unless expressly stated otherwise in the PPA Documents.

Any standards, manuals and guidelines that are not included within the definition of Project Standards must be approved by INDOT prior to use by Design-Build Contractor. Any manuals or documents other than those reflected herein or elsewhere in the PPA Documents require INDOT's prior approval before use in the Work. Design-Build Contractor shall obtain advance prior written approval from INDOT for any Deviation from the Project Standards, in addition to complying with any other requirements regarding requested Deviations set forth in the PPA Documents.

Design-Build Contractor shall be responsible to communicate with the applicable Utility Owner to determine the applicable Adjustment Standards for any Adjustment Work.

3-1.2 Modifications to Department Standards

The following notes apply to the Department standards used on the Indiana Project:

1. Certain standards have been created as internal guidance documents and not as mandatory requirements. However, for purposes of this Project, all provisions of standards, including the figures and tables, are mandatory, and guidelines are to be applied as requirements. All words such as "should," "may," "must," "might," "could," and "can" shall mean "shall" unless the context requires otherwise, as determined in the sole discretion of INDOT. Design-Build Contractor shall disregard qualifying words such as "usually," "normally," and "generally." References to Department practices and policies shall be construed to be mandatory requirements unless the context requires otherwise. It shall be in INDOT's sole discretion to determine when the context does not require a provision to be mandatory.

2. In accordance with Sections 5.2.6 and 5.2.7 of the PPA, if the Department standard expires during the course of this Project, Design-Build Contractor shall contact INDOT to determine whether the standard shall continue to be used or will be replaced.

3. When a reference to "Engineer" relates to design responsibilities or other technical issues, "Engineer" shall mean Design-Build Contractor's Lead Engineer. When a reference to "Engineer" relates to administrative issues, "Engineer" shall mean the Department. It shall be in INDOT's sole discretion to determine whether the context

refers to technical or administrative responsibilities. All references to Department offices and personnel shall mean Design-Build Contractor's similar offices and personnel.

4. All references related to measurement for payment, method of measurement, basis of payment, extra work, contract adjustments, adjustment of unit prices, or similar phrases shall be disregarded by Design-Build Contractor.

5. References to "additional work," "adjustment to compensation," "extra work," "pay extra," "at the expenses to the Department," or similar phrases shall be disregarded. Payment, and adjustments thereto, as more fully described in Section 12 of the PPA, will be full compensation for all Work performed pursuant to the Contract Documents unless specific provisions for additional payments are contained in the Contract Documents.

6. No changes have been made to provisions in any standards that do not apply to this Project, but that provide general information (e.g., descriptions of Department divisions and their duties, descriptions of legal authority, or descriptions of internal Department procedures); however, in some cases it may not be clear whether rights or responsibilities are applicable to Design-Build Contractor. In accordance with Sections 1.3 and 2.1.2.5 of the PPA, if it is unclear whether specific provisions in the standards are applicable to Design-Build Contractor, Design-Build Contractor shall notify INDOT and INDOT shall make that determination in its sole discretion.

7. Design-Build Contractor shall disregard the paragraphs within the standards relating to questions. All questions shall be taken to INDOT.

8. When a standard refers to items that will be performed or provided by the Department or by a division or employee of the Department, Design-Build Contractor shall construe the requirements as applying to Design-Build Contractor unless otherwise specified in the Contract Documents, or unless the context requires otherwise. It shall be in INDOT's sole discretion to determine when the context requires otherwise.

9. When a standard refers to an action being necessary or needed, Design-Build Contractor shall construe the action as required, unless the context requires otherwise, as determined in the sole discretion of INDOT.

10. Phrases relating to item(s) or activity(ies) that "will be" conducted, that are "most easily accomplished by," that "are recommended," that are "desired," that are "usually necessary," that "should preferably be" done, that "might require," that are "necessary" or "as necessary", and that are "required" or "done" shall be construed to be mandatory requirements unless the context requires otherwise, as determined in the sole discretion of INDOT. Phrases relating to activity(ies) that should not be conducted, such as "is not normally used," "is not good practice," "should never be done," "cannot be used," or "should be avoided," shall be construed as prohibited. It shall be in INDOTs sole discretion to determine when the context either requires or does not require a provision to be mandatory.

11. Where the notes refer to items that are indicated in the Plans or special provisions or required in the Plans or special provisions, "plans or special provisions" shall mean Design-Build Contractor's Plans or special provisions.

12. References to approved products or materials shall mean such products or materials approved by INDOT.

13. Design-Build Contractor shall use forms as required to report the same information and in the same format as the Department forms shown in the standards.

14. If Design-Build Contractor believes that an item in the standards is unclear, Design-Build Contractor shall notify INDOT. Regardless of whether Design-Build Contractor notifies INDOT, INDOT shall always have the right to notify Design-Build Contractor if Design-Build Contractor is interpreting a requirement incorrectly.

15. All references to “you” or “your” shall mean Design-Build Contractor unless otherwise directed by INDOT.

16. When a standard refers to items that will be performed or provided by the Department or by a division or employee of the Department, Design-Build Contractor shall construe the requirements as applying to Design-Build Contractor unless otherwise specified in the Contract Documents, or unless the context requires otherwise. It shall be in INDOT’s sole discretion to determine when the context requires otherwise.

17. The following sections of Standard Specification Section 100 – General Provisions are deleted as they are superseded by the PPA: Sections 102, 103.04, 103.05, 104.01, 104.02, 104.03, 105.02, 105.05, 105.06, 105.15, 105.16, 107.06, 107.17, 107.19, 107.22, 107.23, 107.24, 107.25, 108.02, 108.03, 108.08, 108.09, 108.10, 108.11, 108.12, 109 (excepting language specific to pay factors per Standard Specifications), 110, 111, and 113.

18. Section 108.01 of the Standard Specifications is revised to read: “The subcontractor shall be in accordance with the requirements of 105 IAC 11-2-10, Subcontractors.”

3-1.3 List of Standards

Table 3-1: Standards and References

IS: Industry standard, Design-Build Contractor's responsibility to acquire.

W: Standard available online at Author/Agency's website, Design-Build Contractor's responsibility to acquire. (Web sites are listed for some of the standards listed below for information only. The Web sites listed are not guaranteed to be correct. It is ultimately Design-Build Contractor's responsibility to locate the required standard and to determine if the standard has been modified pursuant to this RFP.)

Author/Agency	Title	Availability
INDOT	Standard Specifications http://www.in.gov/dot/div/contracts/standards/book/index.html	W
INDOT	Recurring Special Provisions & Plan Details http://www.in.gov/dot/div/contracts/standards/rsp/index.html	W
INDOT	Unique Special Provisions – Samples Index http://www.in.gov/dot/div/contracts/standards/usp/USPINDEX.xlsx	W
INDOT	INDOT Standard Drawings http://www.in.gov/dot/div/contracts/standards/drawings/index.html	W
INDOT	Design Manual (IDM) including Design Memoranda http://www.in.gov/indot/design_manual/design_manual_2013.htm	W
INDOT	Geotechnical Design Memoranda http://www.in.gov/dot/div/contracts/standards/geomem/memos.html	W
INDOT	Approved Materials List http://www.in.gov/indot/div/mt/appmat/appmat.htm	W
INDOT	Indiana Manual on Uniform Traffic Control Devices (IMUTCD) http://www.in.gov/dot/div/contracts/design/mutcd/mutcd.html	W
INDOT	Traffic Management Strategic Deployment Plan http://www.in.gov/indot/3045.htm	W
INDOT	Work Zone Safety Mobility Policy http://www.in.gov/dot/div/contracts/standards/	W
INDOT	Professional Services Contract Administration Manual http://www.in.gov/indot/2733.htm	W
INDOT	Construction Memorandums http://www.in.gov/dot/div/contracts/conmemo/con_memo.htm	W
INDOT	Geotechnical Design Manual http://www.in.gov/indot/2804.htm	W
INDOT	Public Involvement Policies and Procedures Manual http://www.in.gov/indot/2366.htm	W
INDOT	Total Storm Management Manual http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1000&context=jtrpdocs	W

Author/Agency	Title	Availability
INDOT	Utility Accommodation Policy http://www.in.gov/indot/2389.htm	W
INDOT	Utility Facility Relocations On Construction Contracts (105 IAC 13) http://www.in.gov/indot/2389.htm	W
INDOT	Interstate Highway Congestion Policy http://www.in.gov/indot/2731.htm	W
INDOT	Bridge Inspection Manual http://www.in.gov/dot/div/contracts/standards/bridge/bridgeinspect.htm	W
INDOT	Manual for Frequency of Sampling and Testing and Basis for Use of Materials http://www.in.gov/indot/2736.htm	W
INDOT	Traffic Noise Analysis Procedure http://www.in.gov/indot/files/INDOT_Noise_Policy_June_2011.pdf	W
INDOT	Real Estate Manuals http://www.in.gov/indot/2493.htm	W
INDOT	Right-of-Way Engineering Manual, and Revisions http://www.in.gov/indot/2731.htm	W
INDOT	Hazardous Materials Unit Operating Manual http://www.in.gov/indot/files/manual_2009.pdf	W
INDOT	Cost Estimation System (CES) – Designer Instructions http://www.in.gov/dot/div/contracts/CES%20Designer%20Instructions.pdf	W
AASHTO	T88, T194 and T289	IS
AASHTO	A Guide for Transportation Landscape and Environmental Design	IS
AASHTO	Guide for the Planning, Design, and Operation of Pedestrian Facilities	IS
AASHTO	Guide for the Development of Bicycle Facilities	IS
AASHTO	A Guide for Achieving Flexibility in Highway Design	IS
AASHTO	A Policy on Geometric Design of Highways and Streets	IS
AASHTO	Roadside Design Guide	IS
AASHTO	Highway Safety Design and Operations Guide	IS
AASHTO	Roadway Lighting Design Guide	IS
AASHTO	Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals	IS
AASHTO	An Informational Guide for Roadway Lighting	IS
AASHTO	Standard Specifications for Transportation Materials and Methods of Sampling and Testing	IS
AASHTO	Guide Specifications for Structural Design of Sound Barriers	IS
AASHTO	LRFD Bridge Design Specifications	IS
AASHTO	Standard Specifications for Highway Bridges	IS

Author/Agency	Title	Availability
AASHTO	Manual for Bridge Evaluation	IS
AASHTO	Guide Design Specifications for Bridge Temporary Works	IS
AASHTO	LRFD Bridge Construction Specifications	IS
AASHTO	Bridge Security Guidelines	IS
AASHTO	Manual on Subsurface Investigations	IS
AASHTO/AWS	D1.5M/D1.5:2010 Bridge Welding Code	IS
AASHTOWare	[Information on how to obtain older version pending]	[Pending]
AISC	American Institute of Steel Construction – Steel Construction Manual	IS
FHWA	Flexibility in Highway Design http://www.fhwa.dot.gov/environment/publications/flexibility/	W
FHWA	Code of Federal Regulations, Title 23 (Highways), Chapter 1, Part 752 Landscape and Roadside Development http://www.fhwa.dot.gov/legsregs/directives/cfr23toc.htm	W
FHWA	FHWA-RD-03-031: Distress Identification Manual for the Long-Term Pavement Performance Program https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/ltpp/reports/03031/03031.pdf	W
FHWA	Geotechnical Engineering Circular No. 5: Evaluation of Soil and Rock Properties http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm	W
FHWA	Manual on Uniform Traffic Control Devices (MUTCD) http://mutcd.fhwa.dot.gov/	W
FHWA	Standard Highway Signs Book http://mutcd.fhwa.dot.gov/ser-shs_millennium_eng.htm	W
FHWA	Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volume I & II	IS
FHWA	Alternative Intersection/Interchanges: Informational Report (AIIR) FHWA – HRT-09-060 http://www.fhwa.dot.gov/publications/research/safety/09060/	W
FHWA	Roadway Lighting Handbook http://safety.fhwa.dot.gov/roadway_dept/night_visib/lighting_handbook/	W
FHWA	Geotechnical Engineering Circular No. 7: Soil Nail Walls http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm	W
FHWA	Geotechnical Engineering Circular No. 4: Ground Anchors and Anchored Systems http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm	W
FHWA	FHWA-NHI-05-046, Earth Retaining Structures	IS
FHWA	FHWA-HI-99-007, Rock Slopes	IS
FHWA	FHWA-NHI-01-023, Shallow Foundations	IS
FHWA	FHWA/NHI 10-016-IF-99-025 Drilled Shafts: Construction Procedures and LRFD Design Methods Manual	IS

Author/Agency	Title	Availability
FHWA	FHWA/NHI-10-024, GEC 11 Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Volume 1 http://www.fhwa.dot.gov/engineering/geotech/pubs/nhi10024/	W
FHWA	FHWA/NHI-10-025, GEC 11 Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Volume II http://www.fhwa.dot.gov/engineering/geotech/pubs/nhi10024/	W
FHWA	Technical Manual for Design and Construction of Road Tunnels – Civil Elements, Report No. FHWA – NHI-10-034 http://www.fhwa.dot.gov/bridge/tunnel/pubs/nhi09010/foreward.cfm	W
FHWA	Program Guide Utility Relocation and Accommodation http://www.fhwa.dot.gov/reports/utilguid/	W
FHWA	Highway Performance Monitoring System (HPMS) Field Manual http://www.fhwa.dot.gov/ohim/hpmsmanl/hpms.cfm	W
FHWA	Railroad-Highway Grade Crossing Handbook http://safety.fhwa.dot.gov/xings/com_roaduser/07010/	W
ADA	Americans with Disabilities Act Accessibility Guidelines	IS
ANSI A300 (Part 1)	Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance – Standard Practices	IS
ANSI A300 (Part 2)	Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance – Standard Practices – Part 2 – Fertilization	IS
ANSI A300 (Part 3)	Tree Care Operations – Tree, Shrub and Other Woody Plant – Standard Practices – Part 3 – Tree Support Systems	IS
ANSI Z60.1	American Standard for Nursery Stock	IS
ANSI Z133.1	Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and for Cutting Brush	IS
ANSI/IESNA RP-8-00	American National Standard Practice for Roadway Lighting	IS
ANSI/EIA/TIA	American National Standards Institute/Electronic Industries Alliance/Telecommunications Industry Association (ANSI/EIA/TIA) – 222-G Structural Standards for Antenna Supporting Structures and Antennas 568A 568B.3 Optical Fiber Cabling Components Standards 606 Administration Standard for Telecommunications Infrastructure	IS
TIA/EIA	The Telecommunications Industry Association & Electronic Industries Alliance Standards	IS
ASTM	Annual Books of Standards	IS
Hortus Third	A Concise Dictionary of Plants Cultivated in the United States and Canada (L. H. Bailey Hortorium, 1976)	IS

Author/Agency	Title	Availability
IDEM	Indiana Storm Water Quality Manual http://www.in.gov/idem/stormwater/2363.htm**Error! Hyperlink reference not valid.**	W
IDNR	Indiana Drainage Handbook http://www.in.gov/dnr/water/4893.htm	W
IDNR	Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana http://www.in.gov/dnr/water/5710.htm	W
IEEE	National Electric Safety Code	IS
IES	Roadway Lighting Handbook, RP-8, Addendum: "Designing the Lighting System – Using Roadway Lighting"	IS
IES	DG-5-94, Recommended Lighting for Walkways and Class 1 Bikeways	IS
IES	RP-19-01, Roadway Sign Lighting	IS
IES	RP-8-00, American National Standards for Roadway Lighting	IS
CIE	International Lighting Commission – CIE 127-2007, Technical Report: Measurement of LEDS	IS
Motorola	R56 Standards and Guidelines for Communication Sites	IS
NTCIP	National Transportation Communication for ITS Protocol Standards	IS
IGGA	Guide Specification - Next Generation Concrete Surface (NGCS) Construction on Newly Constructed Roadways http://igga.net/resources/specifications	W
ITE	Manual of Transportation Engineering Studies	IS
ITE	Traffic Engineering Handbook	IS
ITE	Preemption of Traffic Signals Near Railroad Crossings: An ITE Recommended Practice	IS
NCHRP	NCHRP Report 480, A Guide to Best Practices for Achieving Context Sensitive Solutions	IS
NCHRP	Report 350. Recommended Procedures for the Safety Performance Evaluation of Highway Features	IS
NCHRP	Report 672, Roundabouts: An Informational Guide, Second Edition	IS
NEMA	National Electrical Manufacturer Association	IS
NFPA	NFPA 70 - National Electric Code	IS
NFPA	National Electric Safety Code	IS
NFPA	502-Standard for Road Tunnels, Bridges and Other Limited Access Highways	IS
NFPA	Standard for the Installation of Lightning Protection Systems, NFPA 780	IS
NECA	National Electrical Contractors Association Standard of Installation	IS
IEEE	National Electric Safety Code (IEEE C2-2007)	IS
NETA	International Electrical Testing Association Standard ATS	IS

Author/Agency	Title	Availability
UL	Underwriters Laboratories, Inc., Lightning Protection Components, UL 96 and UL 96A	IS
Telcordia	GR 196 Core Issue 2, Generic Requirements for Optical Time Domain Reflectometer (OTDR)	IS
TRB	Highway Capacity Manual	IS
TRB	NCHRP Report 529, Guideline and Recommended Standard for Geofoam Application in Highway Embankments	IS
Bellcore	Technical Advisories and Technical Requirements	IS
AREMA	Manual For Railway Engineering	IS
CSX	Bridge and Track Design Criteria, Specifications, and Standard Drawings	IS
NS	Overhead Grade Separation Design Criteria	IS
NS	NS Guidelines for Design and Construction of Privately Owned Industry Tracks – Chapter X. Bridges	IS
NS	Public Projects Manual	IS
NS	Norfolk Southern Standard Specifications for Materials and Construction	IS
PCI	Bridge Design Manual Volume I & II	IS
PCI	Design Handbook	IS
PCI	Full Depth Deck Panel Guidelines, For Accelerated Bridge Deck Replacement or Construction http://www.pcine.org/cfcs/cmsIT/baseComponents/fileManagerProxy.cfc?method=GetFile&fileID=2D90746A-F1F6-B13E-82A745AB150E0E16	W
CRSI	Concrete Reinforcing Steel Institute Manual of Standard Practice	IS

ATTACHMENT 4-1

UNIQUE SPECIAL PROVISIONS:

Construction

A. Salvage of Onsite/Project Materials.....1
B. Work Area Access.....2
C. Work in Waterways 3

SALVAGE OF ONSITE/PROJECT MATERIALS

The Design-Build Contractor shall salvage 5,280 lineal feet of cables with associated posts and all threaded terminals, turnbuckles and anchor fittings from the existing cable barrier system within the project limits. The cable shall be placed on spools, individual spools of cable shall weigh no more than 14,000 pounds, threaded terminals, turnbuckles and anchor fittings shall be delivered in containers suitable for outside storage. The salvaged materials shall be delivered to the LaPorte District, Rensselaer Subdistrict, 1130 E. Maple Street, Rensselaer, IN 47978. The LaPorte District contact below shall receive 72 hour notice prior to the delivery:

John Claussen
INDOT, Rensselaer Sub Unit 2 Foreman,
315 E. Boyd Blvd.
LaPorte, IN 46350
Phone 219-866-5820 (Office); 219-851-3921 (Cell)
Email JCLAUSSEN@indot.IN.gov

The Design-Build Contractor shall salvage any undamaged end treatments within the project limits as well as any replaced high mast lights/light poles including pole arms and T-bases from the lighting within the project limits. The salvaged materials shall be delivered to the LaPorte District, Wanatah Unit Traffic Yard, 10621 W. US 30, Wanatah, IN 46390. The LaPorte District contact below shall receive 72 hour notice prior to the delivery:

Steve Giese
INDOT, LaPorte District Highway Tech Supervisor 3,
315 E. Boyd Blvd.
LaPorte, IN 46350
Phone 574-910-0009 (Cell)
Email SGIESE@indot.IN.gov

WORK AREA ACCESS

The Design-Build Contractor shall prepare a detailed plan of ingress and egress locations in the Work area along each phase of construction where construction vehicles will be entering the construction zone. The Design-Build Contractor shall submit this detailed plan to the INDOT for approval. Flagging traffic, traffic stoppages, lane closures or arrow boards will not be allowed for this operation. The Design-Builder Contractor shall also provide an extensive, robust plan regarding MOT. Inclusions and requirements for submitted plan may be found within Section 11 MOT.

WORK IN WATERWAYS

Description

This section describes the acceptable materials and methods for dewatering the Work area in waterways.

Materials

The dewatering bag shall be nonwoven, needle punched, 8 ounce polypropylene geotextile with the characteristics in the table below:

Property	**Test Method**	**Minimum Value**
Tensile Strength (Grab)	ASTM D-4632	225 lbs.
Elongation	ASTM D-4632	50%
Puncture	ASTM D-4833	130 lbs.
Mullen Burst	ASTM D-3786	425 psi
Trapezoidal Tear	ASTM D-4533	90 lbs.
UV Resistance	ASTM D-4355	70%
Apparent Opening Size	ASTM D-4751	80 Sieve = .18mm
Permittivity	ASTM D-4491	1.26 sec.-1
Water Flow Rate	ASTM D-4491	100 gpm/square feet

The geotextile seams shall be double stitched with a high strength thread. A Type C certification in accordance with 916 shall be required.

Construction Requirements

The Design-Build Contractor shall use isolation, diversion channels or the pump- around method for dewatering Work areas in waterways shown in the Plans and as described herein. Alternate methods proposed by the Design-Build Contractor for dewatering Work areas shall be submitted and approved by INDOT prior to implementation. The submission shall include any permit modifications necessary. Construction in a waterway shall be sequenced to begin at the most downstream point and work progressively upstream installing required channel and grade control facilities. Work shall be completed in small segments, exposing as little of the channel at a time as practical. Equipment operators shall be contained in the immediate Work area and avoid excessive compacting of the soil surface. During the process of cut and fill, the Design-Build Contractor shall avoid letting side-cast or waste material enter waterways or placing it on unstable areas. Instead, the Design-Build Contractor shall efficiently move excavated material to areas needing fill or to a stockpile with perimeter protection.

Isolation shall only be used in intermittent or ephemeral streams where the proposed Work can be completed between rain events during a period the stream has no flow. Isolation shall not be used when rain is forecasted during the Work period.

Diversion channels shall be constructed using riprap, geotextile or erosion control mats or a combination of these materials so the temporary channel is not erodible while in use. Diversion channels that are expected to

remain in place for more than one month shall be designed to carry a storm event with a 10% exceedance probability.

The pump-around method shall be in accordance with the following:

1. Installation of the pump-around method shall begin upstream of the Work area and proceed downstream.

2. Work shall not be conducted during rain events.

3. Approved erosion and sediment control measures shall be installed prior to construction of the pump-around. No Work shall be performed outside of the limits of the approved Work area. Disturbance within the Work area shall be minimized.

4. A clean water sandbag dike shall be installed upstream of the Work area and then a sediment sandbag dike shall be installed downstream of the Work area. Upstream pool or sump areas and downstream discharge areas shall then be constructed. Pumps shall then be installed to divert the stream flow around the Work area and to dewater the stream within the Work area. Ponding caused by the upstream dike shall not exceed the 1% exceedance probability elevation.

5. Water from the diversion pumps shall be discharged downstream of the Work area onto a stable velocity dissipater consisting of riprap or sandbags.

6. Water from Work area dewatering pumps shall be discharged through a dewatering bag, or other approved device. The dewatering bag shall be located such that discharge water flows back into a stabilized area of the channel downstream of the Work area. The dewatering bag shall be installed per the manufacturer’s recommendations.

7. Equipment shall not be operated in the channel outside of the limits of the Work area. Temporary stream crossings shall only be constructed as approved by the INDOT, and only after any necessary permit modifications are secured.

8. The channel within the Work area shall be graded in accordance with the Plans and all stream restoration measures shall be installed.

9. After a Work area is completed and stabilized, the clean water sandbag dike and diversion pump shall be removed and the stream allowed to re- enter the Work area down to the sediment dike. Sediment shall be allowed to settle out of the water upstream of the sediment dike and then the dewatering pump and sediment dike shall be removed.

10. A pump-around shall also be installed on any tributary or storm drain outfall which contributes base flow to the Work area. This shall be accomplished by locating a clean water dike at the downstream end of the tributary or storm drain outfall and pumping the stream flow around the Work area. Discharge of water pumped from a tributary or storm drain shall be the same as for the main channel discharge.

All areas disturbed by dewatering the Work area in waterways shall be restored to their original condition and re-vegetated to their original conditions or as shown on the Plans.

ATTACHMENT 6-1

ENVIRONMENTAL COMMITMENTS

Environmental Commitments

The following table identifies all the requirements identified in the environmental commitments record of the NEPA approval. Except for those requirements that are specifically identified as being the responsibility of INDOT, Design-Builder Contractor is responsible for complying with all the requirements identified in the following table.

Item No.	Agency Requiring Commitment	TP Attachment 6-1 Environmental Commitment	Responsible Party	Related Section
Environmental Document 1400326 - I-65 ATL SR 2/ Exit 240 to US 30/ Exit 253				
1	USFWS	Minimize woodland impacts in the design of new bridges and mitigate for the loss of trees that cannot be avoided. Individual trees 8-inches in diameter at breast height (DBH) or larger shall be replaced at a ratio of 2:1 as close to the impact area as possible.	Design-Build Contractor	Section 6 Environmental
2	IDNR	Minimize and contain within the project limits in channel disturbance and the clearing of trees and brush	Design-Build Contractor	Section 6 Environmental
3	IDNR	Post "Do Not Mow or Spray" signs along the right of way	Design-Build Contractor	
4	IDNR	Seed and protect all disturbed stream banks and slopes that are 3:1 or steeper with erosion control blankets (follow manufacturer's recommendations for installation); seed and apply mulch on all other disturbed areas	Design-Build Contractor	Section 6 Environmental
5	IDNR	Re-vegetate "low maintenance" areas with a mixture of grasses (excluding all varieties of tall fescue), legumes, and native shrub and hardwood tree species as soon as possible upon completion; low endophyte tall fescue is only allowed be used in "high maintenance" areas.	Design-Build Contractor	Section 6 Environmental
6	IDNR	Do not cut any trees suitable for Indiana bat roosting (greater than 3 inches DBH, living or dead, with loose hanging bark) from April 1 through September 30.	Design-Build Contractor	Section 6 Environmental
7	IDNR	Implement appropriately designed measures for controlling erosion and sediment to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized.	Design-Build Contractor	Section 6 Environmental
8	IDNR	Do not excavate in the low flow area except for the placement of piers, foundations, and riprap, or removal of the old structure.	Design-Build Contractor	Section 13 Structures

Item No.	Agency Requiring Commitment	TP Attachment 6-1 Environmental Commitment	Responsible Party	Related Section
9	IDNR	Use minimum average 6 inch graded riprap stone extended below the normal water level to provide habitat for aquatic organisms in the voids.	Design-Build Contractor	Section 9 Drainage, Section 13 Structures
10	IDNR	The project shall not create conditions that are less favorable for wildlife passage under the structure compared to current conditions. This includes maintaining land under the bridge unarmored with riprap to allow for wildlife passage.	Design-Build Contractor	Section 9 Drainage, Section 13 Structures
11	IDNR	If any archaeological artifacts or human remains are uncovered during construction, work must stop and the discovery must be reported to the Division of Historic Preservation and Archaeology within 2 business days.	Design-Build Contractor	Section 6 Environmental
12	IDNR	Re-vegetate all bare and disturbed areas with a mixture of grasses (excluding all varieties of tall fescue), legumes, and native shrub and hardwood tree species as soon as possible upon completion.	Design-Build Contractor	Section 6 Environmental
13	IDNR	Place all excavated material landward of the floodway.	Design-Build Contractor	Section 7 Roadway
14	IDNR	Do not leave felled trees, brush, or other debris in the floodway. Remove all construction debris from the floodway	Design-Build Contractor	Section 6 Environmental
15	IDNR	Keep the bridge waterway opening free of debris and sediment at all times.	Design-Build Contractor	Section 6 Environmental, Section 9 Drainage
16	IDNR	Plant five trees, at least 2 inches in diameter-at-breast height, for each tree which is removed that is ten inches or greater in diameter-at-breast height within the regulatory floodway or as required by permit conditions.	Design-Build Contractor	Section 6 Environmental
17	IDEM	Limit the physical disturbance of the stream and riparian vegetation, especially large trees overhanging any affected water bodies to only that which is absolutely necessary to complete the project.	Design-Build Contractor	Section 6 Environmental
18	IDEM	Minimize the impacts associated with storm water runoff using appropriate structures and techniques both during the construction phase, and after completion of the project	Design-Build Contractor	Section 9 Drainage
19	IDEM	Take reasonable precautions to minimize fugitive dust emissions from construction and demolition activities. Minimize dirt tracked onto paved roads from unpaved areas.	Design-Build Contractor	Section 6 Environmental
20	IDEM	All facilities slated for renovation or demolition shall be inspected by an Indiana-licensed asbestos inspector prior to renovation or demolition activities. If regulated asbestos-containing material	Design-Build Contractor	Section 6 Environmental

Item No.	Agency Requiring Commitment	TP Attachment 6-1 Environmental Commitment	Responsible Party	Related Section
		(RACM) that may become airborne is found, demolition, renovation, or asbestos removal activities shall be performed in accordance with notification and emission control requirements.		
21	IDEM	Notify IDEM 10 working days prior to the demolition in all cases where a demolition activity will occur (even if no asbestos is found).	Design-Build Contractor	Section 6 Environmental
22	IDEM	Minimize human exposure to lead-based paint chips and dust.	Design-Build Contractor	Section 6 Environmental
23	IDEM	The use of cutback asphalt, or asphalt emulsion containing more than seven percent (7%) oil distillate, is prohibited during the months of April through October.	Design-Build Contractor	Section 6 Environmental, Section 7 Roadway
24	IDEM	Install silt fence or other erosion control measures around the perimeter of any wetlands and/or water bodies to remain undisturbed at the project site.	Design-Build Contractor	Section 6 Environmental
25	IDEM	Stabilize all disturbed areas upon completion of land disturbing activities.	Design-Build Contractor	Section 6 Environmental
26	IDEM	Treat sediment-laden water which otherwise would flow from the project site by using erosion and sediment control measures appropriate to minimize sedimentation.	Design-Build Contractor	Section 6 Environmental
27	IDEM	Manage wastes and unused building materials and disposed of in accordance with all applicable statutes and regulations.	Design-Build Contractor	Section 6 Environmental
28	IDEM	Provide a stable construction site access at all points of construction traffic ingress and egress to the project site.	Design-Build Contractor	Section 6 Environmental
29	IDEM	Keep public or private roadways clear of accumulated sediment that is a result of run-off or vehicle tracking.	Design-Build Contractor	Section 6 Environmental
30	INDOT	Contact INDOT Environmental Services Division immediately if the scope of work or right of way amounts change.	Design-Build Contractor	Section 6 Environmental
31	INDOT	Any work in a wetland area within INDOT's right of way or in borrow/waste areas is prohibited unless specifically allowed in the US Army Corps of Engineers or IDEM permit	Design-Build Contractor	Section 6 Environmental
32	INDOT	Notify the IDEM Spill Line within 24 hours if any potential hazardous materials are discovered during construction with details of the discovery. (Standard 104.26)	Design-Build Contractor	Section 6 Environmental
33	USFWS	Post "DO NOT DISTURB" signs at the construction zone boundaries and	Design-Build Contractor	Section 6 Environmental

Item No.	Agency Requiring Commitment	TP Attachment 6-1 Environmental Commitment	Responsible Party	Related Section
		do not clear trees or understory vegetation outside the boundaries.		
34	USFWS	Restrict below-water work to placement of piers, pilings and/or footings, shaping of the spill slopes around the bridge abutments, and placement of riprap.	Design-Build Contractor	Section 6 Environmental, Section 13 Structures
35	USFWS	Restrict channel work and vegetation clearing to within the width of the normal approach road right of way.	Design-Build Contractor	Section 6 Environmental
36	USFWS	Minimize the extent of artificial bank stabilization.	Design-Build Contractor	Section 6 Environmental
37	USFWS	If riprap is utilized for bank stabilization, extend it below low-water elevation to provide aquatic habitat.	Design-Build Contractor	Section 6 Environmental, Section 9 Drainage
38	USFWS	Implement temporary erosion and siltation control devices such as placement of straw bales in drainage ways and ditches, covering exposed areas with burlap, jute matting or straw, and grading slopes to retain runoff in basins.	Design-Build Contractor	Section 6 Environmental
39	USFWS	Re-vegetate all disturbed soil areas immediately upon project completion.	Design-Build Contractor	Section 6 Environmental
40	USFWS	Avoid all work within the inundated part of the stream channel during the fish spawning season (April 1 through June 30), except for work within sealed structures such as caissons or cofferdams that were installed prior to the spawning season without prior approval of the USFWS and IDNR.	Design-Build Contractor	Section 6 Environmental
Environmental Documents 0101469 and 0200140 - Bridge Replacement and Widening I-65 At Kankakee River				
1	INDOT	Report discover of any archaeological artifacts or human remains are uncovered during construction, demolition, or earthmoving activities, state law (Indiana Code 14-21-1-27 and -29) to the Department of Natural Resources within two (2) business days. In that event, please call (317) 232-1646. Be advised that adherence to Indiana Code 14-21-1-27 and -29 does not obviate the need to adhere to applicable federal statutes and regulations.	Design-Build Contractor	Section 6 Environmental
2	INDOT	Contact INDOT Environmental Services immediately if additional permanent or temporary right-of-way is determined to be required.	Design-Build Contractor	Section 6 Environmental
3	INDOT	Notify the IDEM Spill Line within 24 hours if any potential hazardous materials are discovered during construction with details of the discovery. Then contact the INDOT Environmental Services, Hazardous Materials Unit to organize the proper handling of the material, to be in accordance	Design-Build Contractor	Section 6 Environmental

Item No.	Agency Requiring Commitment	TP Attachment 6-1 Environmental Commitment	Responsible Party	Related Section
		with the IDEM guidelines.		
4	INDOT	Dispose of all solid wastes generated by the project, or removed from the project site, to a properly permitted solid waste processing or disposal facility. Remove all broken concrete and construction debris upon completion of the project.	Design-Build Contractor	Section 6 Environmental
5	INDOT	Obtain all appropriate permits before construction may begin.	Design-Build Contractor	Section 6 Environmental
6	USFWS	Restrict below-water work to placement of piers, pilings and/or footings, shaping of the spill slopes around the bridge abutments, and placement of riprap	Design-Build Contractor	Section 6 Environmental
7	USFWS	Seed and protect all disturbed stream banks and slopes that are 3:1 or steeper with erosion control blankets; seed and apply mulch on all other disturbed areas.	Design-Build Contractor	Section 6 Environmental
8	IDNR	Re-vegetate “low maintenance” and all bare areas with a mixture of grasses (excluding all varieties of tall fescue), legumes and native shrub and hardwood tree species as soon as possible upon completion; low endophyte tall fescue may be used in “high maintenance” areas only.	Design-Build Contractor	Section 6 Environmental
9	IDNR	Do not work in the waterway from April 1 through June 30 without prior written approval of Division of Fish and Wildlife.	Design-Build Contractor	Section 6 Environmental
10	IDNR	Use minimum average 6 inch graded riprap stone extended below the normal water level to provide habitat for aquatic organisms in the voids.	Design-Build Contractor	Section 6 Environmental
11	IDNR	Do no leave felled trees, brush, or other debris in the floodway. Remove all construction debris from the floodway.	Design-Build Contractor	Section 6 Environmental
12	IDNR	Limit equipment staging and access, bridge widening and all other construction activities within the existing footprint of the maintained area of the roadway’s right-of-way.	Design-Build Contractor	Section 6 Environmental, Section 13 Structures
Environmental Document 1172265 – Categorical Exclusion Level 1				
1	INDOT	Implement appropriately designed measures for controlling erosion and sediment to prevent sediment from entering the stream or leaving the construction site. Maintain these measures until construction is complete.	Design-Build Contractor	Section 6 Environmental

Item No.	Agency Requiring Commitment	TP Attachment 6-1 Environmental Commitment	Responsible Party	Related Section
2	IDNR	If any archaeological artifacts or human remains are uncovered during construction, demolition, or earthmoving activities, state law (Indiana Code 14-21-1-27 and -29) requires that the discovery be reported to the Department of Natural Resources within two business days. In that event, call (317) 232-1646. Be advised that adherence to Indiana Code 14-21-1-27 and -29 does not obviate the need to adhere to applicable federal statutes and regulations	Design-Build Contractor	Section 6 Environmental
3	INDOT	If permanent or temporary right-of-way is determined to be required, contact INDOT Environmental Services immediately.	Design-Build Contractor	Section 17 Right of Way
4	INDOT	Control fugitive dust by employing proper wetting, chemical stabilizers, or wind barriers. Minimize dirt tracked onto paved roads from unpaved areas.	Design-Build Contractor	Section 6 Environmental
5	IDEM	If any potential hazardous materials are discovered during construction notify the IDEM Spill Line with details of the discovery within 24 hours. Then contact INDOT Environmental Services, Hazardous Materials Unit, to organize proper handling of the material, in accordance with the IDEM guidelines.	Design-Build Contractor	Section 6 Environmental
6	INDOT	Dispose of all solid wastes generated by the project, or removed from the project site, at a properly permitted solid waste processing or disposal facility. Remove all broken concrete and construction debris upon completion of the project.	Design-Build Contractor	Section 6 Environmental
7	INDOT	Obtain all appropriate permits before construction.	Design-Build Contractor	Section 6 Environmental

ATTACHMENT 7-1

UNIQUE SPECIAL PROVISIONS

Roadway

A. Special Seed Mix 1
B. Topsoil 6

SPECIAL SEED MIX

Description

This work includes soil preparation, native seed mixes, installation methods, maintenance and watering for sowing of native grass and wildflower seed, and other inherent horticultural management practices along and across mitigation areas.

Materials

Native Grass and Forb Seed

A temporary cover shall be included with all seed mixes. The temporary cover shall consist of 10 lbs of Annual Rye (Lolium multiflorum) with 30 lbs of Seed Oats (Avena sativa) for a total temporary seeding rate of 40 lbs/ac.

Design-Build Contractor shall sow seed mixes as shown on drawings and schedules for each area designated for seeding. Design-Build Contractor shall determine the quantity of seed that will be required for each specified seed mix.

Seed Mixture D (Modified) shall be used to restore any disturbed soil along stream banks. This mixture shall be applied at a rate of 15.81 pounds/acre in accordance with the following table:

Botanical Name	**Common Name**	**Rate Oz/ac**
Glyceria striata	Fowl Manna Grass	1
Carex spp.	Wetland Carex	8
Leersia oryzoides	Rice Cut Grass	2
Schoenoplectus tabernaemontani	Bulrush	2
Elymus Canadensis	Prairie Wild Rye	80
Elymus virginicus	Virginia Wild Rye	160
	Subtotal:	253

Mycorrhizal Inoculants shall be commercially produced ectomycorrhizal and endomycorrhizal fungi that improve plant root absorption of soil nutrients. Design-Build Contractor shall furnish mycorrhizal inoculum in a granular or concentrated powder form for areas to be seeded with permanent seed. The product shall contain a minimum of the 4 species of Endomycorrhizae fungi and a minimum of the seven species of Ectomycorrhizae fungi.

Source Quality Control

Seed materials shall be shipped with certificates of inspections required by governing authorities. Shipping shall comply with regulations applicable to landscape materials.

Plant names indicated shall comply with “Standardized Plant Names” as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed should conform generally with names accepted by the nursery trade. Stock provided shall be true to botanical name and legibly tagged.

Seed used shall be of local genotypes, harvested from areas within the same hardiness zone and natural region as that of the Project area whenever possible.

Substitutions of specified seed if not obtainable, Design-Build Contractor shall notify INDOT and present proposal for use of substitutions. INDOT reserves the right to determine material equivalency and make final approval for all substitutions. If local genotypes are unavailable, Design-Build Contractor shall submit list of alternates to INDOT for approval.

Quality

All seed shall be tested in a certified seed laboratory with certified results presented to the Office of the Indiana State Seed Commissioner in writing prior to planting.

All seed shall be of the previous season's crop and the date of the analysis shown on the container shall be within the past nine months of the time of use on this Project. All seed shall be free of prohibited and restricted noxious weeds in accordance with 360 IAC 1.

Amounts of grass and forb seeds in mixes shall be adjusted to achieve 100 percent Pure Live Seed (PLS).

Germination rates shall be at least 90 percent for all grass seed species and at least 75 percent for all forb seed species.

Submittals

Design-Build Contractor shall submit a Type C certification in accordance with 916 for each seed mixture required. The certification shall include botanical and common name, percentage by weight, purity and germination for each seed species.

Design-Build Contractor shall submit a Pure Live Seed (PLS) count spreadsheet listing all seed species to INDOT for final approval prior to installation of any seed.

Maintenance

Design-Build Contractor shall submit a one year maintenance plan for all native seed areas from date of substantial completion through date of final acceptance for approval by INDOT. The maintenance plan shall provide for a monthly maintenance regimen to monitor and control all pests, noxious weeds and exotic species within seeded areas. The maintenance plan shall also provide for watering of all native seed mix areas.

A mowing schedule along with a schedule to control noxious weeds and invasive species shall be specified for a one year period for all native seeding areas for the purpose of controlling exotic invasive plants, reducing weed competition, and shading of native plants.

After seeding is complete, Design-Build Contractor shall conduct a monthly inspection of the site to determine the effectiveness of the maintenance plan and update or modify maintenance approach and practices as needed to promote highest possible performance of seed.

A final exotics control and long term maintenance training session shall be provided to INDOT. Design-Build Contractor shall demonstrate all required

maintenance methods and instruct INDOT on appropriate maintenance methods, field mark special maintenance areas, and provide a maintenance handbook describing methods and timing for recommended maintenance practices.

Construction Requirements

Product Delivery, Storage and Handling

Packaged materials shall be delivered in containers in original packaging showing product name, weight, analysis and name of manufacturer. Materials shall be protected from deterioration during delivery, and while stored at the site.

All seed shall meet best industry standards for testing and labeling. Labels will include name, weight, type of seed, and number of corresponding certified seed report.

Each seed mix shall be supplied and delivered to the job site in separate bags or containers.

If standard mixes are provided premixed by seed supplier, Design-Build Contractor shall have seed mixes shipped to site with appropriate labels and test results.

Each seed container shall have at least one approved Department of Agriculture seed tag on or in the container. The seed tags shall indicate the seed mix name and each seed's botanical name, common name, purity and germination rate.

Planting Season

All seeding shall occur in the spring between March 15 and June 1.

Soil Preparation

Areas that have been re-graded shall have topsoil placed and loosely compacted to at least 85 percent of its maximum dry density. Seeding areas for Herbaceous Riparian Vegetation Mix shall have 3 inches of topsoil. All other areas shall have 6 inches of topsoil.

Soil preparation shall include use of a glyphosate herbicide at least three days prior to installation, tilling, mowing and any other standard methods suitable for establishment of seeded areas as specified. Do not apply fertilizer to the site.

After the grass within the areas to be seeded has been properly treated with herbicide, the soil shall be loosened and tilled to a minimum depth of four inches. Any remaining dead grass or other superficial debris shall be removed from the soil and disposed of offsite.

Native Grass and Forb Seeding

Moist stratified forb seed shall be used in spring plantings.

Design-Build Contractor shall evaluate prepared site conditions and determine the most effective method of seed installation for the areas specified. Multiple installation techniques may be required in order to effectively seed areas to accommodate varying slope, soil type, seed mix type, and site conditions at the time of installation.

Seeding methods may include drill seeding, hand broadcasting, or any other proven method for successful installation of warm season grasses, native forb and seed mixes.

Seed shall be evenly and uniformly distributed over the designated seeding areas.

All varieties of seed in mix may be planted simultaneously provided that each seed type is uniformly applied at the specified rate. Design-Build Contractor shall not sow seed when weather conditions are unfavorable, such as during drought, high winds, or extremely wet conditions.

All seed shall be planted no deeper than 1/8 inch below the surface of the soil. Good seed to soil contact and predation control shall be required regardless of method of installation.

Design-Build Contractor shall apply mycorrhizal inoculates across seeded areas to improve germination and growth rates for all seeded species. Design-Build Contractor shall coordinate with seed supplier to identify the appropriate mycorrhizal inoculates, application rates and methods for all planting areas.

Watering will be required during the establishment period for all native seeded areas. Design-Build Contractor shall make sure that 1/4 inch per week of water is provided to all seeded areas during the establishment period. If sufficient natural rainfall occurs to meet the water requirement, no supplemental watering will be needed. Water used shall be in accordance with 914.09(a).

Design-Build Contractor shall remove and dispose of surplus subgrade material, debris, stone, foreign material and trash from site upon completion of seeding activities.

Maintenance by Design-Build Contractor

The maintenance period shall begin immediately after each plant and or seeded area is planted. Maintenance shall continue for one year until planting has passed final inspection and acceptance.

Any seeded areas not passing final inspection shall be repaired or replaced and maintained for one additional year from the date of replacement.

Maintenance includes watering, weeding, cultivating, mowing, removal of dead materials, pruning, and other necessary operations as directed by INDOT.

If mowing is used as a method of weed control then Design-Build Contractor is responsible for avoiding the seedling plantings. Any damage caused to the seedling plantings by Design-Build Contractor shall be replaced by Design-Build Contractor at no additional cost to the Department. Mowing within the Project limits shall be the responsibility of Design-Build Contractor during the one year warranty period.

Maintenance by INDOT will not begin until final acceptance of all seeding areas has been provided by INDOT.

Inspection and Replacement

Inspections shall be performed prior to the days on which seeding operations are performed and at the conclusion of planting to determine completion, exclusive of replacement plants. Notify INDOT of installation schedule to coordinate site inspections. Site inspections will continue throughout the maintenance period.

Final inspection of seeded areas shall not be made for a minimum period of 21 calendar days after permanent seeding and until seed has germinated and is growing in a satisfactory stand.

If a satisfactory stand of vegetation is not established within 45 days from the date of seeding, the area shall be reseeded or repaired at no additional cost until a stand deemed satisfactory is established.

Deficiencies in the work shall be corrected before final acceptance will be made.

If erosion occurs during the warranty period due to lack of germination of seeded areas, Design-Build Contractor shall repair the eroded areas with topsoil as approved and directed by INDOT.

All replacement seeding shall be of the same mix type, seed species ratios and application rates unless otherwise directed by INDOT.

Beginning at initial acceptance of landscape work and during the one year warranty period, Design-Build Contractor shall make periodic inspections of the work to verify viability of landscape installation. Design-Build Contractor shall submit a written report of inspection findings to INDOT.

TOPSOIL

This shall apply to topsoil obtained from within the Project limits and the Standard Specifications are revised as follows:

SECTION 914.01, BEGIN LINE 4, DELETE AND INSERT AS FOLLOWS:

This topsoil shall consist of loose friable soil, free of refuse, stumps, large roots, rocks over ~~2~~ *1* in. diameter, brush, weeds, or other material which would be detrimental to the proper development of vegetative growth. It shall be capable of supporting normal vegetation as demonstrated by the growth of healthy vegetation on it. It shall not be taken from a source known to contain any of the noxious weeds defined as such in the Indiana State Seed Law, IC 15-4-1.

Topsoil shall have a pH value of ~~6.2 to 7.4~~ *6.0 to 7.0 and an organic matter content of 5 to 10 percent by volume or 2 to 3 percent by dry weight.* Testing for pH value shall be performed in accordance with AASHTO T 289. Testing for organic matter content shall be in accordance with ASTM D2974. Agricultural limestone may be added to topsoil in order to raise the pH to meet specification requirements. The addition of agriculture limestone shall be determined based on tests performed by a laboratory approved by the *INDOT* Office of Geotechnical Services. Topsoil shall not be incorporated into the Work until it is approved.

ATTACHMENT 8-1

UNIQUE SPECIAL PROVISIONS

Pavement

A. PCPP Patching, Full-Depth, Modified

PCCP Patching, Full Depth

Materials shall be in accordance with 506.02, except that concrete used in patches greater than 15 feet in length shall contain a limestone or dolomite coarse aggregate of Class AP quality.

The concrete mix designs for PCCP patches of any length shall be in accordance with 506.03. Change in Materials (a), Adjustments to Materials (b) and Other Adjustments (c) as stated in 506.03, except for admixture dosage rate, will not be allowed for concrete used in patches greater than 15 feet in length.

The concrete mix criteria for PCCP patches less than or equal to 15 feet shall be in accordance with 506.04.

The concrete mix criteria for PCCP patches longer than 15 feet shall be in accordance with 502.04. If high-early strength (HES) concrete is to be used the requirements of 502.04(b) are modified as follows:

a. The water cementitious ratio shall not be greater than 0.020 over the target stated in the CMDP and shall not exceed the maximum allowed by 502.04(b).

b. The design flexural strength of each CMD shall be set such that the minimum opening to traffic strength is achieved at an age consistent with the CMD use in the proposed work, including any lane closure restrictions. The HES, modified concrete shall achieve a minimum of 500 psi in three days.

c. Chemical admixtures types A, B, C, D, E, F and type G will be permitted with prior written approval. A Type C or Type E chemical admixture containing minimal amounts of chloride may be considered by the Engineer for approval. Calcium chloride, Type L, shall not be used in HES, modified concrete.

d. If types F or G chemical admixture are used in the HES modified concrete, the maximum slump for formed PCCP shall be 7 ½ inches.

HES modified concrete can be utilized for patches of 15 feet or less in length.

A trial batch shall be conducted on concretes meeting the mix criteria of either 502.04 or 506.04. Trial batches shall be in accordance with 506.05, except HES concrete is to include the following:

a. Flexural strength for HES modified concrete will be determined at a minimum of 4 hours, 24 hours and 3 days. Three beams will be cast for each beam set tested up to and including 24 hours for the purpose of establishing the rate of strength gain for the HES modified concrete and, if approved by the Engineer, for maturity. An alternate break schedule at ages prior to 24 hours may be adjusted, as directed by the Engineer.

b. If maturity is to be determined, it will be as directed by the Engineer. All molds, facilities and materials necessary to prepare and initially cure the beams shall be provided. In

addition, internal vibrators, per section 5.5 of AASHTO T 23, shall be provided for the purpose of consolidating concrete in the beams. The Department will provide the apparatus to test the beams for flexural strength. Personnel shall be provided to assist the Department in casting, curing and testing the beams.

Job Control is to be in accordance with 506.06 except as follows:

a. Plastic properties will be measured on each sample of concrete from which beams are made.

b. Air content, slump and relative yield for HES modified concrete will be tested on the first load of the day and at least once every 50 cubic yards.

c. For concretes meeting the requirements of 502.04(b) HES modified and 506.04, at least one set (each set consisting of two beams) will be cast for every 150 cubic yards of concrete placed. The beams will be tested to validate the minimum strength of 500 psi at an age of 3-days.

d. Additional beams will be cast for the purpose of opening to traffic for concrete meeting the requirements of 502.04(a), 502.04(b) HES modified concrete, and 506.04. Such beams will be cast from sampling the last load to finish the patching operations for the day’s production for each of the concrete mixes used.

Section 506.07 is modified by including the following:

a. Transverse joint spacing shall not be more than 15 feet. Transverse joints shall not be closer than 6 feet.

b. Placement of patches shall not create remnants of existing panels less than 6 feet in length. If a patch location will create a remnant less than 6 feet in length, the patch shall be extended a minimum of 1 foot beyond the existing D-1 joint location to good solid concrete.

c. Patches that are less than 6’ from an existing D-1 shall be extended a minimum of 1 foot beyond the existing D-1 joint location to good solid concrete.

The concrete mixing and transportation shall be in accordance with 506.08, except that for patches greater than 15 feet in length, the concrete mixing and transportation shall be in accordance with 502.10.

Concrete shall be placed, finished, textured, cured and inspected in accordance with 506.10, except as follows:

a. Patches longer than 6 feet shall be textured by tining in accordance with 504.03.

b. Patches longer than 15 feet shall be cured in accordance with 504.04(a) unless ambient air and concrete temperatures warrant following the requirements in 506.10.

c. PCCP patches shall not be anchored to adjacent CRC pavement. PCCP patches that cover both lanes shall not be anchored to more than

one adjacent PCCP slab, and no PCCP patching slab shall be anchored to more than one adjacent patch. If the situation arises that one patch cannot be anchored, the non-anchored patch shall be the shortest of the available patches.

d. All patches greater than 15 feet and shall be placed in accordance with 502.12.

e. Patches longer than 15 feet shall have joints in accordance with 503.

f. Patches longer than 15 feet shall be finished in accordance with 504.

g. For all PCCP patching, one pressure relief joint consisting of one-quarter inch foam board shall be installed on one end of each patch that is less than 60 feet long. Additional pressure relief joints shall be placed so that no pressure relief joint is further than 60 feet from adjacent pressure relief joints. Patches that are an exact multiple of 60 feet shall have one foam board on the leading edge, the trailing edge, and as required within the interior transverse joints.

Patch Length	Number of 1/4” foam boards required
0’ to <60’	1
60’ to <120’	2
120’ to < 180’	3
180’ to < 240’	4
240’ to <300’	5

h. Dowel bars for load transfer shall be installed in the existing concrete at a 12” interval across the width of the patch with the first dowels offset from the edge of pavement a maximum of 1 foot. Additional placement details and dowel bar size requirements shall follow the standard drawing E506-CCPP-01.

i. Existing D-1 contraction joints shall only be re-established where PCCP patches are longer than 15 feet.

j. When possible, given all other constraints, for patches over 15 feet, new D-1 Contraction Joints shall be located at existing adjacent D-1 joint locations or adjacent mid-panel cracks.

k. Each proposed concrete panel shall only be longitudinally tied to one adjacent PCCP panel. If a panel is adjacent to more than one existing PCCP panel, the patch shall be tied only to the longest contiguous panel.

Opening to traffic shall be in accordance with 506.11 except that patches longer than 15 feet will be controlled as follows:

a. Construction vehicles, equipment, or traffic may be allowed on the PCCP containing HES concrete, when a flexural strength of 425 psi is achieved. The flexural strength shall be determined by averaging two beams cast from each of the job control samples cast for that purpose.

b. Concrete meeting the mix criteria requirement of 502.04(a) shall be in accordance with 502.18 except that the modulus of rupture value shall be 425 psi or greater for all cases.

c. Any construction vehicle or equipment that may damage the PCCP shall not be used on the PCCP unless adequate protection is provided. Approved joint cutting saws may be operated on the PCCP as determined by the Contractor.

ATTACHMENT 8-2

ASPHALT PAVEMENTS QC/QA

SECTION 400 – ASPHALT PAVEMENTS

SECTION 401 – QUALITY CONTROL/QUALITY ASSURANCE, QC/QA, HOT MIX ASPHALT, HMA, PAVEMENT

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 4, DELETE AND INSERT AS FOLLOWS:

401.01 Description

This work shall consist of one or more courses of QC/QA HMA base, intermediate, or surface mixtures constructed on prepared foundations in accordance with 105.03.

401.02 Quality Control

The HMA shall be supplied from a certified HMA plant in accordance with ITM 583; Certified Hot Mix Asphalt Producer Program. The HMA shall be transported and placed according to a Quality Control Plan, QCP, prepared and submitted by the Contractor in accordance with ITM 803; Contractor Quality Control Plans for Hot Mix Asphalt Pavements. The QCP shall be submitted to the Engineer at least 15 days prior to commencing HMA paving operations.

When a safety edge is required for a project, the QCP shall identify the device or devices in accordance with 409.03(c) to be used for constructing the safety edge.

MATERIALS

401.03 Materials

Materials shall be in accordance with the following:

Asphalt Materials
- PG Binder ..... 902.01(a)

Coarse Aggregates 904
- Base Mixtures – Class D or Higher
- Intermediate Mixtures – Class C or Higher
- Surface Mixtures* – Class B or Higher

Fibers ..... AASHTO M 325

Fine Aggregates 904

*Surface aggregate requirements are listed in 904.03(d).

401.04 Design Mix Formula

A design mix formula, DMF, shall be prepared in accordance with 401.05 and submitted in a format acceptable to the Engineer one week prior to use. *The DMF shall be based on the ESAL category identified in the pay item and shall state the mixture designation and maximum particle size in the mixture. No mixture will be accepted for use until the DMF has been assigned a mixture number by the Engineer.*

~~The DMF shall state the maximum particle size in the mixture.~~ 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. ~~Approval of the DMF will be based on the ESAL and mixture designation. A mixture number will be assigned by the Engineer. No mixture will be accepted until the DMF has been approved.~~

The ESAL category identified in the pay item correlates to the following ESAL ranges.

ESAL CATEGORY	ESAL
~~1~~	~~< 300,000~~
*2	~~300,000 to~~ < 3,000,000
3	3,000,000 to < 10,000,000
*4	≥10,000,000 ~~to < 30,000,000~~
~~5~~	~~≥ 30,000,000~~

**A category 2 mixture shall replace a category 1 mixture and a category 4 mixture shall replace a category 5 mixture.*

The plant discharge temperature for any mixture shall not be more than 315°F whenever ~~PG 58-28,~~ PG 64-22~~, PG 64-28~~ or PG 70-22 binders are used or *not more than* 325°F whenever ~~PG 70-28 or~~ PG 76-22 binders are used. QC/QA HMA may be produced using a water-injection foaming device. The DMF shall list the minimum and maximum plant discharge temperatures as applicable to the mixture.

401.05 Volumetric Mix Design

The DMF shall be determined for each mixture from a volumetric mix design by a design laboratory selected from the Department's list of approved Mix Design Laboratories. A volumetric mixture shall be designed in accordance with AASHTO R 35 and the respective AASHTO reference as listed below. *All loose mixture shall be conditioned for 4 h in accordance with AASHTO R 30 prior to testing.*

Bulk Specific Gravity and Density of Compacted Asphalt
Mixtures Using Automatic Vacuum Sealing ..... AASHTO T 331

The single percentage of aggregate passing each required sieve shall be within the limits of the following gradation tables:

Dense Graded, Mixture Designation – Control Point (Percent Passing)					
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm**
Sieve Size					
50.0 mm					
37.5 mm	100.0				
25.0 mm	90.0 - 100.0	100.0			
19.0 mm	< 90.0	90.0 - 100.0	100.0		
12.5 mm		< 90.0	90.0 - 100.0	100.0	100.0
9.5 mm			< 90.0	90.0 - 100.0	95.0 - 100.0
4.75 mm				< 90.0	90.0 - 100.0
2.36 mm	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0*	
1.18 mm					30.0 - 55.0
600 µm					
300 µm					
75 µm	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0	3.0 - 8.0

* The mix design gradation shall be less than or equal to the PCS control point for *all* 9.5 mm ~~category 3, 4 and 5~~ surface mixtures. *The mix design gradation can be greater than the PCS control point when used on non-Department maintained facilities.*

** The total blended aggregate gradation for the 4.75 mm mixture shall have a fineness modulus greater than or equal to 3.30 as determined in accordance with AASHTO T 27.

PCS Control Point for Mixture Designation (Percent Passing)					
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm
Primary Control Sieve	4.75 mm	4.75 mm	2.36 mm	2.36 mm	n/a
PCS Control Point	40	47	39	47	n/a

Open Graded, Mixture Designation – Control Point (Percent Passing)			
	OG9.5mm	OG19.0 mm	OG25.0 mm
Sieve Size			
37.5 mm			100.0
25.0 mm		100.0	70.0 – 98.0
19.0 mm		70.0 – 98.0	50.0 – 85.0
12.5 mm	100.0	40.0 – 68.0	28.0 – 62.0
9.5 mm	75.0 – 100.0	20.0 – 52.0	15.0 – 50.0
4.75 mm	10.0 – 35.0	10.0 – 30.0	6.0 – 30.0
2.36 mm	0.0 – 15.0	7.0 – 23.0	7.0 – 23.0
1.18 mm		2.0 – 18.0	2.0 – 18.0
600 µm		1.0 – 13.0	1.0 – 13.0
300 µm		0.0 – 10.0	0.0 – 10.0
150 µm		0.0 – 9.0	0.0 – 9.0
75 µm	0 – 6.0	0.0 – 8.0	0.0 – 8.0
% of Binder	> 3.0	> 3.0	> 3.0

Dust/Calculated Effective Binder Ratio shall be ~~taken from~~ 0.6 to ~~1.2~~ *1.4.* ~~, when the aggregate gradation passes above the primary control sieve, PCS, control point and 0.8 to 1.6 when the aggregate gradation is less than or equal to the PCS~~. The Dust/Calculated Effective Binder Ratio for 4.75 mm mixtures shall be ~~0.8 to 2.0~~ *in accordance with AASHTO M 323.*

The optimum binder content shall produce *a ΔPb ≤ 0.20 as determined in accordance with ITM 591 and* the following air voids at N_{des}:

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%	4.0%	4.0%	4.0%	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, 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 ~~a minimum of~~ 3.0% reclaimed asphalt shingles by weight of the total mixture ~~are~~ *is* used.

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 ~~2 h~~ *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 ≤ MAF ≤ 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. ~~A new DMF shall be submitted to the District Testing Engineer for approval one week prior to use.~~

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					
~~< 300,000~~	~~6~~	~~50~~	~~75~~	~~91.5~~	~~98.0~~
~~300,000 to~~ < 3,000,000	7	75	115	90.5	98.0
3,000,000 to < 10,000,000	8	100	160	89.0	98.0
≥ 10,000,000 ~~to < 30,000,000~~	8	100	160	89.0	98.0
~~≥ 30,000,000~~	~~9~~	~~125~~	~~205~~	~~89.0~~	~~98.0~~
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	~~16.0~~ *17.0*
9.5 mm	15.0
12.5 mm	14.0
19.0 mm	13.0
25.0 mm	12.0
OG19.0 mm	n/a
OG25.0 mm	n/a

VOIDS FILLED WITH ASPHALT, VFA, CRITERIA @ N_{des}	
ESAL	VFA, %
~~< 300,000~~	~~70 – 80~~
~~300,000 to~~ < 3,000,000	65 – 78
3,000,000 to < 10,000,000	65 – 75
≥ 10,000,000 ~~to < 30,000,000~~	65 – 75
~~≥ 30,000,000~~	~~65 – 75~~
Notes: 1. For 9.5 mm mixtures, the specified VFA range shall be 73% to 76% for design traffic levels ≥ 3 million ESALs. 2. For 25.0 mm mixtures, the specified lower limit of the VFA shall be 67% for design traffic levels < 0.3 million ESALs. 3. For 4.75 mm mixtures, the specified VFA range shall be ~~66~~ *67*% to 79%. 4. For OG9.5 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,* ~~The~~ 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 ~~when entering the HMA plant~~. The RAP coarse aggregate shall pass the maximum size sieve for the mixture being produced ~~and the RAS shall be 100% passing the 1/2 in. (12.5 mm) sieve.~~ RAP for the ESAL category ~~3, 4 and 5~~ *3 and 4* surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.

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

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

where:

A = RAP, % Binder Content *by Mass of RAP*
B = RAP, % ~~in Mixture~~ *by Total Mass of Mixture*
C = RAS, % Binder Content *by Mass of RAS*
D = RAS, % ~~in Mixture~~ *by Total Mass of Mixture*
E = Total, % Binder Content ~~in Mixture~~ *by Total Mass of Mixture*

RAS may be obtained from either pre-consumer or post-consumer asphalt shingles *but the two RAS types shall not be blended together for use in HMA mixtures.*

~~Post consumer asphalt shingles shall be In accordance with AASHTO MP 15 and prepared by a processing company with an IDEM Legitimate Use Approval letter. A copy of this letter shall be submitted to the Engineer. Deleterious material present in post-consumer asphalt shingles shall be limited to the percentages stated in AASHTO MP 15. Pre-consumer and post-consumer asphalt shingles shall not be blended for use in HMA mixtures.~~

Post-consumer asphalt shingles shall be in accordance with the following:

1. *Post-consumer asphalt shingles shall be essentially nail-free.*
2. *Extraneous metallic materials retained on or above the 4.75 mm sieve shall not exceed 0.5% by mass.*
3. *Extraneous non-metallic materials such as glass, rubber, soil, brick, paper, wood and plastic retained on or above the 4.75 mm sieve shall not exceed 1.5% by mass.*
4. *Post-consumer shingles shall be prepared by a processing company with an IDEM Legitimate Use Approval letter. The approval letter shall be submitted to the Engineer.*

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

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

MAXIMUM BINDER REPLACEMENT, %									
Mixture Category	Base and Intermediate						Surface		
	Dense Graded				Open Graded		Dense Graded		
	25.0 Mm	19.0 Mm	12.5 mm	9.5 Mm	25.0 mm	19.0 mm	12.5 Mm	9.5 mm	4.75 mm
~~1~~	~~40.0*~~				~~25.0~~		~~40.0*~~		
2	~~40.0~~ *25.0* *				25.0*		~~40.0~~ *25.0* *		
3	~~40.0~~ *25.0* *				25.0*		25.0*		
4	~~40.0~~ *25.0* *				25.0*		25.0*		
~~5~~	~~40.0*~~				~~25.0~~		~~25.0~~		

~~*RAS materials shall not contribute more than 25% by weight of the total binder content for any HMA mixture.~~
**The contribution of RAS to any HMA mixture shall be ≤ 3.0% by total mass of mixture and ≤ 15.0% binder replacement.*

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

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

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

401.07 Lots and Sublots

Lots will be defined as 5,000 t of base or intermediate mixtures or 3,000 t of surface mixture. Lots will be further sub-divided into sublots not to exceed 1,000 t of base or intermediate mixtures or 600 t of surface mixture. Partial sublots of 100 t or less will be added to the previous sublot. Partial sublots greater than 100 t constitute a full sublot. Partial lots of four sublots or less will be added to the previous lot, if available.

401.08 ~~Job Mix Formula~~ ***Blank***

~~A job mix formula, JMF, shall be developed by a certified HMA producer. A JMF used in the current or previous calendar year that was developed to N_{des} will be allowed. The mixture compaction temperature shall be 300 ± 9°F for dense graded mixtures and 260 ± 9°F for open graded mixtures. The JMF shall list the minimum and maximum plant discharge temperatures as applicable to the mixture. The JMF for each mixture shall be submitted to the Engineer and shall use the same MAF as the DMF. A JMF of the same gyratory compactive effort ESAL category or higher approved in the current calendar year may be submitted for use.~~

401.09 Acceptance of Mixtures

Acceptance of mixtures for ~~binder content~~ VMA 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. Acceptance of mixtures for binder content and air voids at N_{des} will be based on a type D certification in accordance with 402.09 for dense graded mixtures with original contract pay item quantities less than 300 t. Acceptance of mixtures for binder content and air voids at N_{des} for each lot will be based on a type D certification in accordance with 402.09 for dense graded 4.75 mm mixtures.

Acceptance of mixtures for binder content and air voids at N_{des} for each lot will be based on tests performed by the Engineer for open graded mixtures with original contract pay item quantities greater than or equal to 300 t.

Acceptance of mixtures for binder content and air voids at N_{des} will be based on a type D certification in accordance with 402.09 for open graded mixtures with original pay item quantities less than 300 t, except the air voids tolerance shall be ±3.5% from the DMF ~~or JMF~~.

The Engineer will randomly select the location within each sublot for sampling in accordance with ITM 802. The first 300 t of the first sublot of the first lot for each mixture pay item will not be sampled. An acceptance sample will consist of plate samples obtained in accordance with ITM 802 and ITM 580. The Engineer will take immediate possession of the samples.

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 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/~~JMF~~ 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 or a volume of effective binder in the mixture below 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, 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.

A binder draindown test in accordance with AASHTO T 305 for open graded mixtures shall be completed once per lot in accordance with 401.07 and shall not exceed 0.50%.

~~The Engineer's acceptance test results for each sublot will be available after the sublot and testing are complete.~~ *The Engineer will make available the sublot acceptance test results after receiving the sublot quality control results from the Contractor.*

Air voids, binder content and VMA 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).

Pay factors for dense graded mixtures with original contract pay item quantities greater than or equal to one lot will be determined in accordance with 401.19(a). Partial lots of four sublots or less will have pay factors determined in accordance with 401.19(b) if the previous lot is not available.

Pay factors for dense graded mixtures with original contract pay item quantities greater than or equal to 300 t and less than one lot and open graded mixtures will be determined in accordance with 401.19(b).

The Contractor may request an appeal of the Engineer's test results in accordance with 401.20.

Fibers incorporated into the mixture will be accepted on the basis of a type A certification for the specified material properties for each shipment of fibers. Fibers from different manufacturers and different types of fibers shall not be intermixed.

In the event that an acceptance sample is not available to represent a sublot, all test results of the previous sublot will be used for acceptance. If the previous sublot is not available, the subsequent sublot will be used for acceptance.

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.

CONSTRUCTION REQUIREMENTS

401.10 General

Equipment for HMA operations shall be in accordance with 409. The Contractor shall submit to the Engineer written documentation that includes the manufacturer's make, model, serial number, manufactured year, and the

manufacturer's literature with pictures. The documentation shall be submitted prior to use and shall certify that the paving equipment proposed for the project is new and includes the modifications or have been modified in accordance with the following.

The paver shall be equipped with means of preventing the segregation of the coarse aggregate particles when moving the mixture from the paver hopper to the paver augers. The means and methods used shall be in accordance with the paver manufacturer's instructions and may consist of chain curtains, deflector plates, or other such devices, or any combination of these.

The following specific requirements shall also apply to identified HMA pavers:

1. Blaw-Knox HMA pavers shall be equipped with the Blaw-Knox Materials Management Kit, MMK.

2. ~~Cedarrapids~~ *Cedarapids* HMA pavers shall be those that were manufactured in 1989 or later.

3. Barber-Green/Caterpillar HMA pavers shall be equipped with deflector plates as identified in the December, 2000 Service Magazine entitled "New Asphalt Deflector Kit {6630-DFL, 6631-DFL, or 6640-DFL}".

The Contractor is also required to demonstrate to the Engineer prior to use, that the modifications to the paving equipment have been implemented on all pavers to be used on the project.

Fuel oil, kerosene, or solvents shall not be transported in open containers on equipment. Cleaning of equipment and small tools shall not be accomplished on the pavement or shoulder areas.

Segregation or flushing or bleeding of HMA mixtures will not be allowed. Corrective action shall be taken to prevent continuation of these conditions. Segregated or flushed or bleeding HMA mixtures shall be removed if directed. All areas showing an excess or deficiency of binder shall be removed and replaced.

All mixtures that become loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced.

401.11 Preparation of Surfaces to be Overlaid

The subgrade shall be shaped to the required grade and sections, free from all ruts, corrugations, or other irregularities, and uniformly compacted and approved in accordance with 207. Milling of an existing pavement surface shall be in accordance with 306. Surfaces on which a mixture is placed shall be free from objectionable or foreign materials at the time of placement.

Prior to placing an open graded mixture, the underlying HMA course shall have a full width base seal applied in accordance with 415. The base seal materials shall be applied within three calendar days after all density cores in accordance with 401.16 have been obtained.

Rubblized concrete pavements 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.

All partially completed sections of roadway that are 8 in. or less in thickness shall be proofrolled prior to the placement of additional materials unless otherwise directed by the Engineer. Proofrolling shall be accomplished in accordance with 203.26. The contact pressure shall be 70 to 80 psi. Soft yielding areas shall be removed and replaced.

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.

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.

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 ~~or JMF~~ 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 ~~*18°F below the minimum mixing temperature as shown on the JMF for mixtures compacted in accordance with 402.15.*~~ *315°F whenever PG 64-22 or PG 70-22 binders are used or less than 325°F whenever PG 76-22 binders are used.*

Planned HMA courses greater than 220 lb/sq yd placed under traffic, shall be brought up even with each adjacent lane at the end of each work day. Planned HMA courses less than or equal to 220 lb/sq yd shall be brought forward concurrently, within practical limits, limiting the work in one lane to not more than one work day of production before moving back to bring forward the adjacent lane. Traffic shall not be allowed on open graded mixtures.

Hydraulic extensions on the paver will not be allowed for continuous paving operations. Fixed extensions or extendable screeds shall be used on courses greater than the nominal width of the paver except in areas where the paving width varies. Hydraulic extensions may be used in tapers and added lanes less than 250 ft in length.

Automatic slope and grade controls shall be used as outlined in the QCP.

HMA mainline and HMA shoulders which are 8 ft or more in width shall be placed with paving equipment in accordance with 409.03(c)1.

When laying mixtures with density not controlled by cores, the speed of the paver shall not exceed 50 ft per minute. Rollers shall be operated to avoid shoving of the HMA and at speeds not to exceed 3 mph. However, vibratory rollers will be limited to 2.5 mph.

The finished thickness of any course shall be at least two times but not more than four times the maximum particle size as shown on the DMF, except 4.75 mm mixtures shall be at least 1.5 times but not more than 3 times the maximum particle size shown on the DMF.

A safety edge shall be constructed at locations where a dense graded intermediate mixture or a surface mixture is constructed adjacent to an aggregate or earth shoulder.

Vibratory rollers in accordance with 409.03(d)4 shall not be operated in the vibratory mode at locations indicated on the plans. Oscillatory rollers in accordance with 409.03(d)5 will be allowed for use but the vertical impact force capability shall not be used. Density acceptance shall be in accordance with 401.16.

401.15 Joints

Longitudinal joints in the surface shall be at the lane lines of the pavement. Longitudinal joints below the surface shall be offset from previously constructed joints by approximately 6 in., and be located within 12 in. of the lane line.

Hot poured joint adhesive in accordance with 906 shall be applied to longitudinal joints constructed between two adjacent HMA courses in the top course of dense graded intermediate mixtures and all 4.75 mm, 9.5 mm and 12.5 mm surface mixture courses. This includes joints within the traveled way as well as between any of the following: traveled way and an auxiliary lane; traveled way and a paved shoulder; and auxiliary lane and a paved shoulder.

The material shall be heated in a jacketed, double boiler melting kettle. The kettle shall have an attached pressure feed wand system with applicator shoe.

The joint adhesive shall be applied to the face of the previously constructed edge at the joint using a wand applicator. Prior to application of the joint adhesive, the joint face shall be dry and free of loose material and foreign objects. The adhesive shall be applied on the joint face 1/8 in. thick at the temperature recommended by the manufacturer. Excess joint adhesive shall not be allowed to pool on the top of the previously constructed pavement course or the pavement to be overlaid. The application of the adhesive shall be made within the same day, but at least 30 minutes prior to construction of the longitudinal joint.

All 9.5 mm and 12.5 mm surface mixture longitudinal joints that have the joint adhesive applied shall be sealed using SS-1h or AE-NT asphalt emulsion in accordance with 902.01(b). The sealing operation shall not begin until all density cores in accordance with 401.16 and 401.20 have been obtained and the installation of pavement corrugations, when specified in accordance with 606, has been completed.

The liquid asphalt sealant shall be a minimum width of 24 in., centered on the joint line, and shall be extended, when necessary, to provide coverage beyond the edge of the pavement corrugation. The sealant shall be applied at an application rate of 0.03 ±0.01 gal./sq yd onto a dry surface, free of any foreign or loose material, using a distributor in accordance with 409.03(a). Areas receiving greater than 0.04 gal./sq yd shall be lightly broomed to reduce the effects of excess sealant on the pavement surface. The sealant temperature at the time of application shall be at least 135°F and shall not exceed 180°F. The ambient air and pavement temperatures at the time of application shall be greater than 32°F.

Temporary pavement markings in accordance with 801.12 shall be offset a sufficient distance from the longitudinal joint so as not to obstruct the installation of the pavement corrugations or the application of the liquid asphalt sealant. The sealant shall be cured a minimum of five days prior to applying the permanent pavement traffic markings in accordance with 808.

Transverse joints shall be constructed by exposing a near vertical full depth face of the previous course. For areas inaccessible to rollers, other mechanical devices shall be used to achieve the required density.

If constructed under traffic, temporary transverse joints shall be feathered to provide a smooth transition to the driving surface.

401.16 Density

Acceptance will be based on lots and sublots in accordance with 401.07.

Density of the compacted dense graded mixture will be determined from cores except where:

(a) the total planned lay rate to be placed over a shoulder existing prior to the contract award is less than 385 lb/sq yd; or

(b) the first lift of material placed at less than 385 lb/sq yd over a shoulder existing prior to the contract award.

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

Open graded mixtures shall be compacted with six passes of a static tandem roller and will be assigned a value of 84.0% MSG. Vibratory rollers shall not be used on open graded mixtures.

Compaction of 4.75 mm mixtures shall be in accordance with 402.15, except vibratory rollers shall be operated in static mode and the vertical impact force capability of oscillatory rollers shall not be used.

Compaction of mixtures with original contract pay item quantities less than 300 tons shall be in accordance with 402.15.

Density acceptance by cores will be based on samples obtained from two random locations selected by the Engineer within each sublot in accordance with ITM 802. One core shall be cut at each random location in accordance with ITM 580. The transverse core location will be located so that the edge of the core will be no closer than 3 in. from a confined edge or 6 in. from a non-confined edge of the course being placed. The maximum specific gravity will be determined from the samples obtained in 401.09.

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform 6 in. diameter pavement sample. Coring shall be completed prior to the random location being covered by the next course. Surface courses shall be cored within two work days of placement. Damaged 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 will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A or AASHTO T 275, 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).

401.17 Pavement Corrugations

Pavement corrugations shall be in accordance with 606.

401.18 Pavement Smoothness

Pavement smoothness will be accepted by means of a profilograph, a 16 ft long straightedge, or a 10 ft long straightedge as described below.

(a) Profilograph

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

1. The design speed is greater than 45 mph.

2. The traveled way or ramp lane width is constant and is 0.1 mi in length or longer.

3. The HMA is placed on a milled surface or the total combined planned lay rate of surface, intermediate, and base courses is 385 lb/sq yd or greater.

The profilogram produced shall become the property of the Department. The profilograph shall remain the property of the Contractor.

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

If the original contract pay item quantity for a surface mixture is less than or equal to one sublot, the item will be exempt from profilograph operation and the smoothness will be accepted in accordance with 401.18(b).

If the posted speed limit for an entire smoothness section is less than or equal to 45 mph, the section will be exempt from profilograph operation and the smoothness within the section will be accepted in accordance with 401.18(b).

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

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

2. In accordance with 401.18(b) for the portion of the section with a posted speed limit less than or equal to 45 mph.

At locations where the profilograph is required, it shall be used on the surface course and on any dense graded intermediate course immediately below the surface course.

(b) 16 ft Straightedge and 10 ft Straightedge

The Department will furnish and operate 16 ft and 10 ft straightedges as described below. The 16 ft straightedge is used to accept smoothness along the direction of mainline traffic and the 10 ft straightedge is used to accept smoothness transverse to the direction of mainline traffic. This includes longitudinal smoothness on public road approaches and median crossovers.

For contracts which include the Profilograph, HMA pay item, the 16 ft long straightedge will be used to accept longitudinal smoothness on surface courses at the following locations:

1. All mainline traveled way lanes shorter than 0.1 mi.

2. All mainline traveled way lanes within smoothness sections with posted speed limits less than or equal to 45 mph throughout the entire section length.

3. All mainline traveled way lanes at locations exempted from profilograph operation in accordance with ITM 912.

4. All tapers.

5. All turn lanes, including bi-directional left turn lanes.

6. All ramps with design speeds of 45 mph or less.

7. All acceleration and deceleration lanes associated with ramps with design speeds of 45 mph or less.

8. All shoulders.

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

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

(c) Smoothness Correction

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

At locations where the profilograph is being used on a surface course, all areas having a high or low point deviation in excess of 0.3 in. shall be corrected. All smoothness sections with a deficient profile index in accordance with 401.19(c) shall be corrected. Underlying courses that are exposed by corrective action shall be milled to a depth of 1 1/2 in and replaced with surface course. After the corrective action is taken on a surface course, the profilograph shall be operated throughout the entire affected smoothness section to verify the adequacy of the corrective action.

At locations where the 16 ft straightedge is used, the pavement variations shall be corrected to 1/4 in. or less. When the 10 ft straightedge is used, the pavement variations shall be corrected to 1/8 in. or less.

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

401.19 Pay Factors

(a) Dense Graded Mixture ≥ One Lot

Pay factors, PF, are calculated for the ~~binder content,~~ air voids at N_{des} VMA 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:

$$\cancel{PF = (105.00 - 0.50 \times (100.00 - PWL))/100}$$
$$PF = (0.50 \times PWL) + 55.00$$

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

$$\cancel{PF = (100.00 - 0.000020072 \times (100.00 - PWL)^{3.5877})/100}$$
$$PF = (0.625 \times PWL) + 43.75$$

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%, 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.

~~Binder content, air~~ *Air* voids, VMA, 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:

$$\text{Lot PF} = \cancel{0.20(PF_{BINDER})} + \cancel{0.35}\ \mathit{0.30}(PF_{VOIDS}) + \cancel{0.10}\ \mathit{0.35}(PF_{VMA}) + 0.35(PF_{DENSITY})$$

where:

Lot PF = Lot Composite Pay Factor for Mixture and Density
~~PF_{BINDER} = Lot Pay Factor for Binder Content~~
PF_{VOIDS} = Lot Pay Factor for Air Voids at N_{des}
PF_{VMA} = Lot Pay Factor for VMA 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 ~~binder content,~~ air voids at N_{des}, VMA at N_{des}, and density will be used to determine the Lot Pay Factors.

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

SPECIFICATION LIMITS				
MIXTURE				
	LSL*		USL**	
~~Binder Content, %~~	~~– 0.40 from JMF~~		~~+ 0.40 from JMF~~	
Air Voids at N_{des}, %	2.60		5.40	
Voids In Mineral Aggregate at N_{des}, %	~~Greater of~~		~~Lesser of~~	
	Spec ~~– 0.50~~	~~JMF – 1.20~~	Spec + 2.00	~~JMF + 1.20~~
DENSITY				
	LSL*		USL**	
Roadway Core Density (% Gmm), %	91.00		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:

Dense Graded Mixture

$$SCPF = \cancel{0.20(PF_{BINDER})} + \cancel{0.35}\ \mathit{0.30}(PF_{VOIDS}) + \cancel{0.10}\ \mathit{0.35}(PF_{VMA}) + 0.35(PF_{DENSITY})$$

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} = Lot Pay Factor for Binder Content
PF_{VOIDS} = Sublot Pay Factor for Air Voids at N_{des}
PF_{VMA} = Sublot Pay Factor for VMA at N_{des}
$PF_{DENSITY}$ = Sublot Pay Factor for Density

If the SCPF for a sublot is less than 0.85, 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.

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

$$q = L \times U \times (SCPF - 1.00)/MAF$$

where:

q = quality assurance adjustment for the sublot
L = sublot quantity
U = unit price for the material $/ton
SCPF = sublot composite pay factor

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

BINDER CONTENT		
~~Dense Graded~~	Open Graded	Pay Factor
~~Deviation from JMF (± %)~~	Deviation from ~~JMF~~ *DMF* (± %)	
~~≤ 0.2~~	≤ 0.2	1.05
~~0.3~~	0.3	1.04
~~0.4~~	0.4	1.02
~~0.5~~	0.5	1.00
~~0.6~~	0.6	0.90
~~0.7~~	0.7	0.80
~~0.8~~	0.8	0.60
~~0.9~~	0.9	0.30
~~1.0~~	1.0	0.00
~~> 1.0~~	> 1.0	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.		

~~VMA~~		
~~Dense Graded~~	~~Open Graded~~	~~Pay Factor~~
~~Deviation from JMF (± %)~~	~~Deviation from JMF (± %)~~	
~~≤ 0.5~~		~~1.05~~
~~> 0.5 and ≤ 1.0~~	~~All~~	~~1.00~~
~~> 1.0 and ≤ 1.5~~		~~0.90~~
~~> 1.5 and ≤ 2.0~~		~~0.70~~
~~> 2.0 and ≤ 2.5~~		~~0.30~~
~~> 2.5~~		~~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.~~		

VMA		
Dense Graded	*Open Graded*	*Pay Factor*
Deviation from Spec Minimum	*Deviation from Spec Minimum*	
> + 2.5		*Submitted to the Office of Materials Management**
> + 2.0 and ≤ + 2.5		*0.25*
> + 1.5 and ≤ + 2.0		*0.65*
> + 0.5 and ≤ + 1.5		*1.05*
≥ 0.0 and ≤ + 0.5	*All*	*1.00*
≥ - 0.5 and < 0.0		*0.85*
≥ - 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*
< - 2.5		*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 ~~JMF~~ *DMF* (± %)	Deviation from ~~JMF~~ *DMF* (± %)	
≤ 0.5	≤ 1.0	1.05
> 0.5 and ≤ 1.0	> 1.0 and ≤ 3.0	1.00
1.1	3.1	0.98
1.2	3.2	0.96
1.3	3.3	0.94
1.4	3.4	0.92
1.5	3.5	0.90
1.6	3.6	0.84
1.7	3.7	0.78
1.8	3.8	0.72
1.9	3.9	0.66
2.0	4.0	0.60
> 2.0	> 4.0	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.		

For mixtures produced during a plant's adjustment period, pay factors based on the ~~JMF~~ *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	Open Graded	
≥ 97.0		Submitted to the Office of Materials Management*
95.6 - 96.9		1.05 - 0.01 for each 0.1% above 95.5
94.0 - 95.5		1.05
93.1 - 93.9		1.00 + 0.005 for each 0.1% above 93.0
92.0 - 93.0	84.0	1.00
91.0 - 91.9		1.00 - 0.005 for each 0.1% below 92.0
90.0 - 90.9		0.95 - 0.010 for each 0.1% below 91.0
89.0 - 89.9		0.85 - 0.030 for each 0.1% below 90.0
≤ 88.9		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.		

The pay factors will be rounded to the nearest 0.01.

(c) Smoothness

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

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

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

where:

q_s = quality assurance adjustment for smoothness for one section
PF_s = pay factor for smoothness
n = number of layers
A = area of the section, sq yd
S = planned spread rate for material, lb/sq yd
T = conversion factor: 2,000 lb/ton
U = unit price for the material, $/ton.

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

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

$$Q_s = \sum q_s$$

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

PAY FACTORS FOR SMOOTHNESS ($PI_{0.0}$) ZERO BLANKING BAND	
Design Speed greater than 45 mph	
Profile Index in./0.1 mi.	Pay Factor, PFs
Over 0.00 to 1.20	1.06
Over 1.20 to 1.40	1.05
Over 1.40 to 1.60	1.04
Over 1.60 to 1.80	1.03
Over 1.80 to 2.00	1.02
Over 2.00 to 2.40	1.01
Over 2.40 to 3.20	1.00
Over 3.20 to 3.40	0.96
All pavement with a profile index ($PI_{0.0}$) greater than 3.40 in. shall be corrected to a profile index less than or equal to 3.40 in.	

The total quality assurance adjustment is calculated as follows:

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

where:

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

401.20 Appeals

If the QC test results do not agree with the acceptance test results *in a sublot*, a request, along with *a comparison of* the QC *and acceptance* test results, may be made in writing for additional testing *of that sublot*. The appeal sample will be analyzed in a lab different than the lab that analyzed the original sample ~~when requested by the Contractor~~ *at the discretion of the Engineer*.

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 the density cores.

A $500.00 credit adjustment will be included in a quality adjustment pay item in accordance with 109.05.1(e) for each appealed sublot that did not result in an improvement to the SCPF or LCPF.

~~Additional testing may be requested for one or more of the following tests: MSG, BSG of the gyratory specimens, binder content, or BSG of the density cores.~~

The request for the appeal ~~for MSG, BSG of gyratory specimens, binder content or BSG of the density cores~~ *of a sublot* shall be submitted within seven calendar days of receipt of the Department's written results for the ~~lot accepted under 401.19(a) or the sublot accepted under 401.19(b). The sublot and specific test(s) shall be specified at the time of the appeal request. Only one appeal request per lot for mixture accepted under 401.19(a) or sublot for mixture accepted under 401.19(b) is allowed. Upon approval of the appeal, the Engineer will perform additional testing as follows~~ *sublot*.

The backup ~~or new~~ sample will be tested in accordance with the applicable test method for the ~~test~~ *sublot* requested *for all tests exceeding the sublot standard deviation criteria*.

(a) MSG

The backup MSG will be dried in accordance with ITM 572 and mass determined in water in accordance with AASHTO T 209.

(b) BSG of the Gyratory Specimen

New gyratory specimens will be prepared and tested in accordance with AASHTO T 312 from the backup sample.

(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.

(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, if required.

The appeal results will replace all previous test result for acceptance of mixture in accordance with 401.09 and density in accordance with 401.16. The results will be furnished to the Contractor.

401.21 Method of Measurement

HMA mixtures will be measured by the ton of the type specified, in accordance with 109.01(b). The measured quantity will be divided by the MAF to determine the pay quantity.

Milled shoulder corrugations will be measured in accordance with 606.02.

Joint adhesive will be measured by the linear foot in accordance with 109.01(a). Liquid asphalt sealant will be measured by the linear foot.

401.22 Basis of Payment

The accepted quantities for this work will be paid for at the contract unit price per ton for QC/QA-HMA, of the type specified, complete in place.

Payment for furnishing, calibrating, and operating the profilograph, and furnishing profile information will be made at the contract lump sum price for profilograph, HMA.

Adjustments to the contract payment with respect to mixture, density, and smoothness for mixture produced will be included in a quality adjustment pay item in accordance with 109.05.1.

Milled shoulder corrugations will be paid for in accordance with 606.03.

Joint adhesive will be paid for at the contract unit price per linear foot, complete in place. Liquid asphalt sealant will be paid for at the contract unit price per linear foot.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Joint Adhesive, _____ (course type)	LFT
Liquid Asphalt Sealant	LFT
Profilograph, HMA	LS
QC/QA-HMA, _____, _____, _____, _____mm (ESAL[1]) (PG[2]) (Course[3]) (Mix[4])	TON

(1) ESAL Category as defined in 401.04
(2) Number represents the high temperature binder grade. Low temperature grades are - 22
(3) Surface, Intermediate, or Base
(4) Mixture Designation

Preparation of surfaces to be overlaid shall be included in the cost of other pay items.

Coring and refilling of the core holes shall be included in the cost of other pay items within this section.

No payment will be made for additional anti-stripping additives, appeal coring or traffic control expenditures related to coring operations.

The cost of removing and replacing soft and yielding areas shall be included in the cost of other pay items in this section.

Corrections for pavement smoothness shall be included in the cost of other pay items within this section.

The price for Profilograph, HMA will be full compensation regardless of how often the profilograph is used or how many profilograms are produced.

If QC/QA-HMA intermediate over QC/QA-HMA base mixtures are specified, QC/QA-HMA intermediate mixture may be considered as a substitute for the QC/QA-HMA intermediate and QC/QA-HMA base 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 mixture. The quantity and amount for QC/QA-HMA intermediate mixture shall equal the sum of the contract quantities and amounts

shown for QC/QA-HMA intermediate and QC/QA-HMA base mixtures. The unit price for QC/QA-HMA intermediate mixture shall be equal to the sum of contract amounts divided by the sum of contract quantities. Payment for the QC/QA-HMA intermediate mixture will be made at the unit price per ton for QC/QA-HMA intermediate mixture. No payment will be made for additional work or costs which may result due to this change.

SECTION 402 – HOT MIX ASPHALT, HMA, PAVEMENT

The Standard Specifications are revised as follows:

SECTION 402, BEGIN LINE 3, DELETE AND INSERT AS FOLLOWS:

402.01 Description

This work shall consist of one or more courses of miscellaneous mixtures constructed in accordance with 105.03.

402.02 Quality Control

The HMA shall be supplied from a certified HMA plant in accordance with ITM 583; Certified Hot Mix Asphalt Producer Program. The HMA shall be transported and placed according to a Quality Control Plan, QCP, prepared and submitted by the Contractor in accordance with ITM 803; Contractor Quality Control Plans for Hot Mix Asphalt Pavements. The QCP shall be submitted to the Engineer at least 15 days prior to commencing HMA paving operations.

When a safety edge is required for a project, the QCP shall identify the device or devices in accordance with 409.03(c) to be used for constructing the safety edge.

MATERIALS

402.03 Materials

Materials shall be in accordance with the following:

Asphalt Materials
- PG Binder ..... 902.01(a)

Coarse Aggregates 904
- Base Mixtures – Class D or Higher
- Intermediate Mixtures – Class C or Higher
- Surface Mixtures* – Class B or Higher

Fine Aggregates 904

* Surface aggregate requirements are listed in 904.03(d).

402.04 Design Mix Formula

A DMF shall be prepared in accordance with ~~402.05~~ *401.04* and submitted in a format acceptable to the Engineer one week prior to use. ~~The DMF shall state the maximum particle size in the mixture, the calibration factor and test temperature to be used for the determination of binder content using ITM 586 or ITM 571, and a MAF. Approval of the~~

The DMF will be based on the ESAL and mixture designation as follows.

Mixture Type	~~Type A~~	Type B	Type C	Type D
Design ESAL	~~200,000~~	~~2,000,000~~ *<3,000,000*	~~9,000,000~~ *3,000,000 to <10,000,000*	~~11,000,000~~ *≥10,000,000*
Surface	~~4.75 mm~~	4.75 mm	4.75 mm	4.75 mm
	~~9.5 mm~~	9.5 mm	9.5 mm	9.5 mm
	~~12.5 mm~~	12.5 mm	12.5 mm	12.5 mm
Surface – PG Binder	~~64-22~~	64-22	70-22	70-22
Intermediate	~~9.5 mm~~	9.5 mm	9.5 mm	9.5 mm
	~~12.5 mm~~	12.5 mm	12.5 mm	12.5 mm
	~~19.0 mm~~	19.0 mm	19.0 mm	19.0 mm
	~~25.0 mm~~	25.0 mm	25.0 mm	25.0 mm
Intermediate – PG Binder	~~64-22~~	64-22	64-22	70-22
Base	~~19.0 mm~~	19.0 mm	19.0 mm	19.0 mm
	~~25.0 mm~~	25.0 mm	25.0 mm	25.0 mm
Base – PG Binder	~~64-22~~	64-22	64-22	64-22

Surface 4.75 mm mixtures shall not be used when the required lay rate shown on the plans is greater than 100 lb/sq yd. Surface 12.5 mm mixtures shall not be used when the required lay rate shown on the plans is less than 195 lb/sq yd.

The plant discharge temperature for any mixture shall not be more than 315°F whenever ~~PG 58-28,~~ PG 64-22, ~~PG 64-28~~ or PG 70-22 binders are used ~~or 325°F whenever PG 70-28 or PG 76-22 binders are used~~. HMA may be produced using a water-injection foaming device. The DMF shall list the minimum and maximum plant discharge temperatures as applicable to the mixture.

~~The Engineer will assign a mixture number. No mixture will be accepted until the DMF has been approved.~~ *No mixture will be accepted for use until the DMF has been assigned a mixture number by the Engineer.*

402.05 Volumetric Mix Design

The DMF shall be determined for each mixture from a volumetric mix design in accordance with 401.05.

A DMF developed for a QC/QA HMA mixture may be used and the source or grade of the binder may be changed; however, the high temperature grade shall meet the minimum requirements of 402.04.

The MAF equals the G_{mm} 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 ≤ MAF ≤ 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.

402.06 ~~Job Mix Formula~~ *Blank*

~~The job mix formula, JMF, shall be an approved JMF in accordance with 401.08. of the same gyratory compaction effort ESAL category or higher, and submitted in a format acceptable to the Engineer and shall use the same MAF as the DMF. The JMF shall state the maximum particle size in the mixture and the calibration factor and test temperature to be used for the determination of binder content using the ignition oven. Approval of the JMF will be based on the ESAL and mixture designation. No mixture will be accepted until the JMF has been approved.~~

~~All changes in the type or source of aggregate shall require the submittal of a new DMF for approval.~~

402.07 Mix Criteria

(a) Composition Limits for HMA Transverse Rumble Strip Mixtures

Transverse rumble strip mixtures shall be ~~type A~~ *type B* surface in accordance with 402.04. A MAF in accordance with 402.05 will not apply. Aggregate requirements of 904.03(d) do not apply.

(b) Composition Limits for HMA Wedge and Leveling Mixtures

The mixture shall consist of surface or intermediate mixtures in accordance with 402.04. Aggregate requirements of 904.03(d) do not apply when the wedge and leveling mixture is covered by a surface or intermediate mixture.

(c) Composition Limits for Temporary HMA Mixtures

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

(d) Composition Limits for HMA Curbing Mixes

The mixture shall be HMA surface ~~type A~~ *type B* in accordance with 402 except 402.05 shall not apply and RAP shall not be used. The binder content shall be 7.0% and the gradations shall meet the following.

HMA CURBING GRADATIONS	
Sieve Size	Percent Passing
1/2 in. (12.5 mm)	100.0
3/8 in. (9.5 mm)	80.0 - 100.0
No. 4 (4.75 mm)	73.0 ± 5.0
No. 30 (600 µm)	20.0 - 50.0
No. 200 (75 µm)	6.0 - 12.0

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.

402.08 Recycled Materials

Recycled materials *shall be in accordance with 401.06 except type B mixtures shall correspond to category 2 mixtures, type C mixtures shall correspond to category 3 mixtures and type D mixtures shall correspond to category 4 mixtures.*

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

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

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

~~where:~~

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

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

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

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

~~MAXIMUM BINDER REPLACEMENT, %~~							
~~Mixture Category~~	~~Base and Intermediate~~				~~Surface~~		
	~~Dense Graded~~				~~Dense Graded~~		
	~~25.0 mm~~	~~19.0 mm~~	~~12.5 mm~~	~~9.5 mm~~	~~12.5 mm~~	~~9.5 mm~~	~~4.75 mm~~
~~A~~	~~40.0*~~				~~40.0*~~		
~~B~~	~~40.0*~~				~~40.0*~~		
~~C~~	~~40.0*~~				~~25.0~~		
~~D~~	~~40.0*~~				~~25.0~~		

~~*RAS materials shall not contribute more than 25% by weight of the total binder content for any HMA mixture.~~

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

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

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

402.09 Acceptance of Mixtures

Acceptance of mixtures will be in accordance with the Frequency Manual on the basis of a type D certification in accordance with 916. The test results shown on the certification shall be the quality control tests representing the material supplied and include air voids and binder content. Air voids tolerance shall be ± 1.5% and binder content tolerance shall be ± 0.7% from DMF ~~or JMF~~.

Single test values and averages will be reported to the nearest 0.1%. Rounding will be in accordance with 109.01(a).

Test results exceeding the tolerance limits will be considered as a failed material and adjudicated in accordance with 105.03.

CONSTRUCTION REQUIREMENTS

402.10 General

Equipment for HMA operations shall be in accordance with 409. The Contractor shall submit to the Engineer prior to use a written Certificate of Compliance that the proposed paving equipment has been modified in accordance with 401.10 or is new and includes the modifications.

Fuel oil, kerosene, or solvents shall not be transported in open containers on any equipment at any time. Cleaning of equipment and tools shall not be accomplished on the pavement or shoulder areas.

Segregation, flushing or bleeding of HMA mixtures will not be allowed. Corrective action shall be taken to prevent continuation of these conditions. Areas of segregation, flushing or bleeding shall be corrected, if directed. All areas showing an excess or deficiency of asphalt materials shall be removed and replaced.

All mixtures that become loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced.

Mixture shall not be dispatched from the plant that cannot be spread and compacted before sundown of that day, unless otherwise specified.

402.11 Preparation of Surfaces to be Overlaid

The subgrade shall be shaped to the required grade and sections, free from all ruts, corrugations, or other irregularities, and uniformly compacted and approved in accordance with 207. Milling of an existing surface shall be in accordance with 306. Surfaces on which a mixture is placed shall be free from objectionable or foreign materials at the time of placement.

Prior to placing an open graded mixture, the underlying HMA course shall have a full width base seal applied in accordance with 415. The base seal materials shall be applied within three calendar days upon completion of paving the underlying HMA course.

Compacted aggregate bases and rubblized 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.

402.12 Weather Limitations

HMA courses less than 110 lb/sq yd are to be placed when the ambient and surface temperatures are 60°F or above. HMA courses equal to or greater than 110 lb/sq yd but less than 220 lb/sq yd are to be placed when the ambient and surface temperatures are 45°F or above. HMA courses equal to or greater than 220 lb/sq yd and HMA curbing are to be placed when the ambient and surface temperatures are 32°F or above. Mixture shall not be placed on a frozen subgrade. However, HMA courses may be placed at lower temperatures, provided the density of the HMA course is in accordance with 402.16.

All partially completed sections of roadway that are 8 in. or less in thickness shall be proofrolled prior to the placement of additional materials unless otherwise directed by the Engineer. Proofrolling shall be accomplished in accordance with 203.26. The contact pressure shall be 70 to 80 psi. Soft yielding areas shall be removed and replaced.

402.13 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 ~~or JMF~~ for a given pay item, the MAF will be applied to the applicable portion of the mixture for each. Mixtures in areas inaccessible to laydown equipment or mechanical devices may be placed by other methods.

The temperature of each mixture at the time of spreading shall ~~not~~ be ~~more~~ *less* than ~~18°F below the minimum mixing temperature as shown on the DMF or JMF~~ *315°F whenever PG 64-22 or PG 70-22 binders are used.*

Planned HMA courses greater than 220 lb/sq yd placed under traffic shall be brought up even with each adjacent lane at the end of each work day. Planned HMA courses less than or equal to 220 lb/sq yd shall be brought forward concurrently, within practical limits, limiting the work in one lane to not more than one work day of

production before moving back to bring forward the adjacent lane. Traffic shall not be allowed on open graded mixtures.

Hydraulic extensions on the paver will not be allowed for continuous paving operations. Fixed extensions or extendable screeds shall be used on courses greater than the nominal width of the paver except in areas where the paving widths vary. Hydraulic extensions may be used on approaches, tapers, and added lanes less than 250 ft in length.

HMA shoulders which are 8 ft or more in width shall be placed with automatic paving equipment.

HMA mixtures in hauling equipment shall be protected by tarps from adverse weather conditions or foreign materials. Adverse weather conditions include, but will not be limited to, precipitation or temperatures below 45°F.

The speed of the paver shall not exceed 50 ft per minute when spreading mixtures.

Automatic slope and grade controls shall be required except when placing mixtures on roadway approaches which are less than 200 ft in length or on miscellaneous work. The use of automatic controls on other courses where use is impractical due to project conditions may be waived by the Engineer.

The finished thickness of each course shall be at least two times but not more than four times the maximum particle size as shown on the DMF ~~or JMF~~. The finished thickness of wedge and level mixtures shall be at least 1 1/2 times but not more than six times the maximum particle size as shown on the DMF ~~or JMF~~. Feathering may be less than the minimum thickness requirements.

Transverse rumble strips shall be placed to ensure uniformity of height, width, texture, and the required spacing between strips. A tack coat in accordance with 406 shall be applied on the pavement surface prior to placing the mixture. The tack coat may be applied with a paint brush or other approved methods.

A safety edge shall be constructed at locations where an intermediate mixture or a surface mixture is constructed adjacent to an aggregate or earth shoulder.

Vibratory rollers in accordance with 409.03(d)4 shall not be operated in vibratory mode at locations indicated on the plans. Oscillatory rollers in accordance with 409.03(d)5 will be allowed for use but the vertical impact force capability shall not be used. Density acceptance shall be in accordance with 402.15.

402.14 Joints

Longitudinal joints in the surface shall be at the lane lines of the pavement. Longitudinal joints below the surface shall be offset from previously constructed joints by approximately 6 in., and be located within 12 in. of the lane line.

Transverse joints shall be constructed by exposing a near vertical full depth face of the previous course.

If constructed under traffic, temporary transverse joints shall be feathered to provide a smooth transition to the driving surface.

402.15 Compaction

The HMA mixture shall be compacted with equipment in accordance with 409.03(d) immediately after the mixture has been spread and finished. Rollers shall not cause undue displacement, cracking, or shoving.

A roller application is defined as one pass of the roller over the entire mat. Compaction operations shall be completed in accordance with one of the following options.

NUMBER OF ROLLER APPLICATIONS							
Rollers	Courses ≤ 440 lb/sq yd					Courses > 440 lb/sq yd	
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 1	Option 2
Three Wheel	2		4			4	
Pneumatic Tire	2	4				4	
Tandem	2	2	2			4	
Vibratory				6			8
Oscillatory					6	-	-

A reduced number of applications on a course may be approved if detrimental results are being observed.

Compaction equipment shall be operated with the drive roll or wheels nearest the paver and at speeds not to exceed 3 mph. However, vibratory rollers will be limited to 2.5 mph. Rolling shall be continued until applications are completed and all roller marks are eliminated.

Compaction operations shall begin at the low side and proceed to the high side of the mat. The heaviest roller wheel shall overlap its previous pass by a minimum of 6 in.

Longitudinal joints shall be compacted in accordance with the following:

(a) For confined edges, the first pass adjacent to the confined edge, the compaction equipment shall be entirely on the hot mat 6 in. from the confined edge.

(b) For unconfined edges, the compaction equipment shall extend 6 in. beyond the edge of the hot mat.

All displacement of the HMA mixture shall be corrected at once by the use of lutes or the addition of fresh mixture as required. The line and grade of the edges of the HMA mixture shall not be displaced during rolling.

The wheels shall be kept properly moistened with water or water with detergent to prevent adhesion of the materials to the wheels.

Areas inaccessible to rollers shall be compacted thoroughly with hand tampers or other mechanical devices in accordance with 409.03(d)7 to achieve the required compaction. A trench roller, in accordance with 409.03(d)6, may be used to obtain compaction in depressed areas.

The final two roller applications shall be completed at the highest temperature where the mixture does not exhibit any tenderness.

Vehicular traffic will not be allowed on a course until the mixture has cooled sufficiently to prevent distortions.

Transverse rumble strips shall be compacted with vibratory compacting equipment in accordance with 409.03(d)7 unless otherwise stated.

402.16 Low Temperature Compaction Requirements

Compaction for mixtures placed below the temperatures listed in 402.12 shall be controlled by density determined from MSG of the plate samples and cores cut from the compacted pavement placed during a low temperature period. Samples shall be obtained in accordance with ITM 580. Acceptance will be based on a plate sample and two cores. The Engineer will randomly select the locations in accordance with ITM 802. The transverse core location will be located so that the edge of the core will be no closer than 3 in. from a confined edge or 6 in. from a non-confined edge of the course being placed.

For compaction of HMA during low temperature periods with quantities less than 100 t per day, acceptance may be visual.

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform 6 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.

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.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring within a specific section 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 shall be expressed as:

Density = 100 x BSG/MSG

where:

BSG = average bulk specific gravity
MSG = maximum specific gravity

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166 Method A or AASHTO T 275, 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%.

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.

402.17 Pavement Corrugations
Pavement corrugations shall be in accordance with 606.

402.18 Pavement Smoothness
Pavement smoothness will be in accordance with 401.18 except profilograph requirements will not apply.

402.19 Method of Measurement
HMA mixtures will be measured by the ton of the type specified, in accordance with 109.01(b). The measured quantity will be divided by the MAF to determine the pay quantity.

HMA rumble strips will be measured by the linear foot of each transverse strip, complete in place.

Milled pavement corrugations will be measured in accordance with 606.02.

402.20 Basis of Payment
The accepted quantities for this work will be paid for at the contract unit price per ton for HMA, of the type specified complete in place.

HMA rumble strips will be paid for at the contract unit price per linear foot, of each transverse strip complete in place.

Milled pavement corrugations will be paid for in accordance with 606.03.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
HMA Transverse Rumble Strips	LFT
HMA for Temporary Pavement, Type __*__	TON
HMA Wedge and Level, Type __*__	TON

* Mixture type

Preparation of surfaces to be overlaid shall be included in the cost of other pay items in this section.

No payment will be made for additional anti-stripping additives.

The cost of removing and replacing soft yielding areas shall be included in the cost of other pay items in this section.

No payment will be made for coring operations and related traffic control expenditures required in 402.16.

Corrections for pavement smoothness including removal and replacement of pavement, shall be included in the cost of other pay items in this section.

ATTACHMENT 8-3

CERTIFIED HMA PRODUCER PROGRAM

INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT

CERTIFIED HOT MIX ASPHALT PRODUCER PROGRAM
ITM 583-16P

1.0 SCOPE.

1.1 This procedure covers the requirements for a HMA plant to become a Certified Hot Mix Asphalt Producer. Mixtures produced shall be QC/QA HMA in accordance with 401, HMA in accordance with 402, and Stone Matrix Asphalt (SMA) in accordance with 410.

1.2 This procedure may involve hazardous materials, operations and equipment and may not address all of the safety problems associated with the use of the test method. The user of this ITM is responsible for establishing the appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES. Documents required by the Program may be maintained electronically or by hard copy.

2.1 AASHTO Standards.

R 30 Mixture Conditioning of Hot Mix Asphalt
R 35 Superpave Volumetric Design for Hot Mix Asphalt (HMA)
R 46 Designing Stone Matrix Asphalt (SMA)
T 2 Sampling of Aggregates
T 11 Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
T 27 Sieve Analysis of Fine and Coarse Aggregates
T 30 Mechanical Analysis of Extracted Aggregate
R 66 Sampling Bituminous Materials
T 166 Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens.
T 209 Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt Paving Mixtures
T 248 Reducing Samples of Aggregate to Testing Size
T 255 Total Evaporable Moisture Content of Aggregate by Drying
T 269 Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
T 275 Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens
T 305 Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures
T 312 Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

T 331 Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method
T 344 Evaluation of Superpave Gyratory Compactor (SGC) Internal Angle of Gyration Using Simulated Loading

2.2 ASTM Standards.

D 5821 Determining the Percentage of Fractured Particles in Coarse Aggregate

2.3 ITM Standards.

207 Sampling Stockpiled Aggregates
220 Class AS Aggregate for Use in SMA Mixture
571 Quantitative Extraction of Asphalt/Binder and Gradation of Extracted Aggregate from HMA Mixtures
572 Drying HMA Mixtures
580 Sampling HMA
581 Performance Graded Binder Approved Supplier Certification (ASC) Program
584 Bulk Specific Gravity of Aggregate Blends with Recycled Aggregate
586 Binder Content by Ignition
587 Reducing HMA Samples to Testing Size
588 Percent Within Limits (PWL)
590 Total Aggregate Bulk Specific Gravity Determination from Extracted HMA or SMA Mixture
591 Delta Pb (ΔPb) Determination for Dense Graded HMA or SMA Mixture
902 Verifying Sieves
903 Verifying Ovens
905 Verifying Vacuum Systems
906 Verifying Mechanical Shakers
908 Verifying Calibrations Settings for Superpave Gyratory Compactors
909 Verifying Thermometers
910 Verifying Balances
916 Verification of Calipers

2.4 A Certified HMA plant laboratory shall have the following current documents on file:

2.4.1 Indiana Department of Transportation Standard Specifications (Includes applicable Supplemental Specifications)

2.4.2 Pertinent contract Special Provisions

2.4.3 Indiana HMA Quality Assurance Certified Technician Program Manual

2.4.4 All applicable ITM, AASHTO, and ASTM Test Methods

2.4.5 Testing equipment calibrations or verifications

2.4.6 Mix design, DMF, for each Mixture

2.4.7 Fines correction data for the mixture and recycled materials for each DMF

2.4.8 Type A certifications for the PG 58-28 and PG 64-22 binder materials

2.4.9 Type A certifications for the SBR polymer latex

2.4.10 PG 64-28 and PG 70-22 binder test reports from an AASHTO accredited laboratory whenever PG 58-28 and PG 64-22 are in-line blended with SBR polymer latex

2.4.11 Process control test results

2.4.12 Type D certifications issued to active Department contracts

2.5 A Certified HMA plant shall have the following current documents on file:

2.5.1 The Quality Control Plan (QCP) for the HMA plant

2.5.2 Bill of ladings of the binder from each Supplier for a minimum period of three years

2.5.3 Weigh tickets from most current date of production of HMA

2.5.4 Instructions from the Supplier concerning storage and handling of the binder

2.5.5 Flow meter calibration reports and flow computer printouts whenever in-line blending with SBR polymer latex

2.5.6 The IDEM Legitimate Use Approval letter from the post-consumer asphalt shingle processing company

2.5.7 HMA plant calibrations for each DMF

2.5.8 Daily diary

2.5.9 Annual calibration of HMA plant scales and verification of meters

2.5.10 Fiber certification from the manufacturer

2.5.11 Instructions from the manufacturer concerning storage and handling of fibers

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

3.1 Addenda. Any addition or deletion to the QCP

3.2 Addenda Summary Sheet. A page of the QCP that is used to record a brief description of addenda until such time that the revisions are incorporated into the QCP

3.3 Actual Binder Content. The binder content determined in accordance with ITM 586 or the total of the binder content determined in accordance with ITM 571 and the binder absorption percent from the DMF

3.4 Certified Asphalt Technician. An individual who has successfully completed the requirements of the Department Hot Mix Asphalt QA/QC Certified Technician Training Program

3.5 Certified HMA Plant. A HMA plant that meets the requirements of the Program, continues to be under the same ownership, and is approved by the Department

3.6 Corrective Action. Corrective action shall include, but is not limited to, investigation for cause, correction of known cause, or re-testing

3.7 Coarse Aggregate. Aggregate that has a minimum of 20 percent retained on the No. 4 sieve

3.8 District. The Department District Office responsible for administrating the materials and tests function in a local area of the state

3.9 Fine Aggregate. Aggregate that is 100 percent passing the 3/8 in. sieve and a minimum of 80 percent passing the No. 4 sieve

3.10 Mixture. QC/QA HMA, HMA, or SMA produced for the Department's use in accordance with ITM 583 and the Specifications

3.11 Moving Average. Average of the last four or five tests as stated in the QCP

3.12 National Institute of Standards and Technology (NIST). A federal technology agency that develops and applies technology, measurements, and standards

3.13 Office of Materials Management. An office of the Indiana Department of Transportation, located at 120 S. Shortridge Rd. in Indianapolis, Indiana 46219-0389

3.14 Producer. A company or owner who shall assume responsibility for a Certified HMA Plant. A Producer, in accordance with ITM 581, may modify a PG binder from a Supplier by in-line blending SBR polymer latex at the HMA plant for immediate use.

3.15 Program. ITM 583, Certified Hot Mix Asphalt Producer Program

3.16 QCP Annex. A page of the QCP, located in the Appendix, that is used to record revisions for HMA Plant major components, Certified Asphalt Technicians, and movement of the HMA Plant

3.17 Qualified Technician. An individual who has successfully completed the written and proficiency testing requirements of the Department Qualified Laboratory and Technician Program

3.18 Supplier. A Supplier shall be a refinery or terminal that produces modified or unmodified PG binders in accordance with ITM 581.

3.19 Water-Injection Foaming. Water-injection foaming is a technology that allows a reduction in the temperature at which mixtures are produced and placed.

4.0 SIGNIFICANCE AND USE. The Certified Hot Mix Asphalt Producer Program is a program whereby the Producer takes responsibility for the production of quality mixture in accordance with contract requirements, and the Department monitors the Producers production, sampling, and testing procedures.

5.0 PRODUCER PERSONNEL. The Producer personnel shall include a Management Representative, Certified Asphalt Technician, and a Qualified Technician, if applicable.

5.1 Management Representative. The Management Representative shall be responsible for all aspects of mixture production and control at the HMA plant and on the pavement as required by the Program.

5.2 Certified Asphalt Technician. The Certified Asphalt Technician shall compact and analyze the mixture specimens, and perform the maximum specific gravity test. The technician shall supervise all other sampling and testing of materials, the maintenance of control charts, and the maintenance of the diary.

5.3 Qualified Technician. The Qualified Technician shall conduct all sampling and testing used for acceptance of materials produced in accordance with 402. The tests required to determine the air void content in the HMA shall be conducted by a Certified Asphalt Technician.

6.0 LABORATORY.

6.1 Process control testing shall be performed at the HMA Plant or as permitted in 6. 3. The Producer shall provide and maintain a laboratory for process control testing. The laboratory shall have the necessary space, equipment, and supplies for the tests to be performed.

6.2 The laboratory testing equipment shall meet the requirements of the test methods identified for the required sampling and testing, except that an electronic balance shall be provided. The electronic balance shall be readable to 0.1 g and accurate to 0.2 g or 0.1 percent of the test load, whichever is greater, at any point within the range of use. The gyratory compactor shall tilt the specimen mold at an average internal angle of 1.16 ± 0.02° as determined in accordance with AASHTO T 344. The gyratory compactor shall be on the Department's List of Approved Superpave Gyratory Compactors.

6.3 Performance of process control tests at laboratory facilities other than at the HMA Plant will be permitted provided the laboratory facilities are owned by the Producer, all test procedure criteria are satisfied in accordance with 6.2, and the test results are furnished in writing to the HMA Plant within two working days.

6.4 The Engineer shall be permitted access to inspect any laboratory used for process control testing, and witness process control activities during production of mixtures.

7.0 TEST EQUIPMENT CALIBRATION.

7.1 The test equipment furnished by the Producer shall be properly calibrated or verified and maintained within the limits described in the applicable test method.

7.2 The Producer shall calibrate or verify equipment at the frequency indicated.

7.3 The equipment calibration or verification documentation shall be kept on file for a minimum period of three years and include:

7.3.1 A description of the equipment calibrated or verified including Model and Serial Number

7.3.2 Name of the person performing the calibration or verification

7.3.3 Identification of the calibration equipment used, if any (namely, standard weights, proving rings, thermometers, etc.)

7.3.4 Last date calibration or verification was performed and next due date

7.3.5 A reference to the procedure used

7.3.6 Detailed records showing the results of the calibration or verification performed

7.4 The testing equipment shall be calibrated or verified in accordance with the following:

Equipment	Requirement	Minimum Frequency	Procedure
Balances	Standardize	12 mo.	ITM 910
Gyratory Compactor	Verify Ram Pressure, Angle of Gyration, Frequency of Gyration, LVDT	1 mo.	ITM 908
Gyratory Compactor Internal Angle	Verification	12 mo.	AASHTO T 344
Gyratory Mold and Plate Dimensions	Verification	12 mo.	AASHTO T 312
Ignition Oven	Conduct Lift Test	Weekly	Operators Manual
Ignition Oven Balance	Standardize	12 mo.	ITM 910
Mechanical Shakers	Verify Sieving Thoroughness	12 mo.	ITM 906
Ovens	Verify Temperature Settings	12 mo.	ITM 903
Sieves	Verify Physical Condition	12 mo.	ITM 902
Thermometers	Verification	12 mo.	ITM 909
Vacuum Chamber	Verification	3 mo.	ITM 905

7.5 The equipment used to calibrate or verify the testing equipment shall be NIST traceable and shall be calibrated or verified in accordance with the following frequencies:

Calibration Equipment	Testing Equipment	Minimum Frequency
Bore Gauge	Gyratory Compactor Molds – AASHTO T 312	12 mo.
Calipers	Gyratory Compactor Molds – AASHTO T 312	12 mo.
Dynamometer or Load Cell & Proving Ring	Gyratory Compactor – AASHTO T 312	24 mo.
Height Gage Blocks	Gyratory Compactor – AASHTO T 312	24 mo.
Height Billet	Gyratory Compactor – AASHTO T 312	24 mo.
Vacuum Gage	Vacuum Systems – ITM 905	12 mo.
Weights, Min. Class 3	Balances – ITM 910	12 mo.

8.0 DIARY

8.1 The Producer shall maintain a diary at the HMA Plant. The diary shall be an open format book with at least one page devoted to each day mixture is produced.

8.2 The Producer shall keep the diary on file for a minimum period of three years.

8.3 Entries in the diary shall as a minimum include:

8.3.1 The type of mixture produced and quantity, DMF number, and the contract or purchase order number for each mixture

8.3.2 The time the sample was obtained and the time the test was completed

8.3.3 Non-conforming tests and the resulting corrective action taken

8.3.4 Any significant events or problems

8.4 The Certified Asphalt Technician or Management Representative shall sign the entry in the diary. On occasion the diary may be signed by another person; however, the diary is required to be counter-signed by the Certified Asphalt Technician or Management Representative.

9.0 MATERIALS SAMPLING AND TESTING. The Producer shall designate the sampling and sample reduction procedures, test methods, sampling locations, and size of samples necessary for the quality control. Mixture shall be sampled in accordance with ITM 580. Testing of the samples shall be completed within two working days. Test values shall be reported to the nearest 0.1 percent, except as follows:

a) Coarse aggregate angularity shall be reported to the nearest 1 percent

b) Mixture temperature shall be reported to the nearest 1°F

c) Mixture moisture content and draindown shall be reported to the nearest 0.01 percent

Rounding shall be in accordance with 109.01(a). The Producer shall keep the test results on file for a minimum period of three years.

The VMA shall be calculated in accordance with AASHTO R 35 using the actual binder content from the most recent binder content determination. The maximum specific gravity shall be mass determined in water in accordance with AASHTO T 209. Gyratory specimens shall be compacted at 300 ± 9°F for dense graded mixtures and SMA, and 260 ± 9°F for open graded mixtures. The volume of effective binder, Vbe, in the mixture shall be calculated as the mixture VMA minus the mixture Air Voids.

9.1 QC/QA HMA and SMA Mixtures. The following items shall be addressed in the QCP as a minimum:

9.1.1 Aggregates

a) Stockpile

b) Blended

9.1.2 Binder

9.1.3 Recycled Materials

a) Actual Binder Content

b) Gradation

c) Moisture Content

d) Coarse Aggregate Angularity

e) Bulk Specific Gravity of Recycled Aggregate

9.1.4 Mixture Sampled at the HMA plant

a) Actual Binder Content

b) Gradation

c) Aggregate degradation value (for SMA mixtures only) – once per lot

d) Moisture Content

e) Temperature

f) Draindown (for open graded and SMA mixtures only)

9.1.5 Mixture Sampled from the Pavement

a) Air Voids

b) VMA

c) Actual Binder Content

d) Gradation

e) Dust/calculated effective binder ratio

f) Moisture Content (for surface mixtures only)

g) Bulk Specific Gravity

h) Maximum Specific Gravity

i) Volume of Effective Binder, Vbe

9.2 **HMA Mixtures.** HMA mixture produced concurrently with QC/QA HMA mixture shall be sampled and tested in accordance with 9.1. All other HMA mixture shall be sampled at the HMA plant or the roadway at the Contractor's option and tested for Binder Content, Coarse Aggregate Angularity (mixtures containing gravel), Gradation, and Air Voids in accordance with the following minimum frequency:

9.1.6 The first 250 t and each subsequent 1000 t of each DMF in a construction season for base and intermediate mixtures

9.1.7 The first 250 t and each subsequent 600 t of each DMF in a construction season for surface mixtures

10.0 BLANK

11.0 CONTROL LIMITS. The control limits shall only apply to QC/QA HMA and SMA mixtures.

11.1 Target mean values shall be as follows:

11.1.1 The target value for the air **void** content shall be as designated by the Producer.

11.1.2 The target values for the binder content of the mixture and the VMA shall be as indicated on the DMF.

11.2 Control limits for single test values shall be as follows:

Parameter	Maximum % Passing, Control Limits (±)		
	Aggregate Stockpiles	Blended Aggregate Base and Intermediate Mixtures	Blended Aggregate Surface Mixture
3/4 in	10.0	10.0	
1/2 in.	10.0	10.0	10.0
No.4	10.0	10.0	10.0
No.8	10.0	10.0	8.0
No.16	8.0	8.0	8.0

No.30	6.0	6.0	4.0
No.50	6.0	6.0	4.0
No.100	6.0	6.0	3.0
No.200	2.0	2.0	2.0

Parameter	Control Limits
Binder Content of Mixture and RAP, %	± 0.7
Binder Content of RAS, %	± 3.0
VMA @ Ndes, % (QC/QA HMA)	± 1.0
VMA @ N_{75}, Minimum % (9.5 mm SMA)	17.0
VMA @ N_{75}, Minimum % (12.5 mm SMA)	16.0
Target Air Voids % (Dense Graded Mixtures, SMA)	± 1.0
Target Air Voids % (Open Graded Mixtures)	± 3.0

12.0 RESPONSE TO TEST RESULTS.

12.1 The Producer shall take corrective action when the control limits for QC/QA HMA and SMA or specification limits for HMA Mixtures are exceeded for the appropriate properties of Mixture Binder Content, Air Voids, or VMA.

12.2 The Producer shall document the action taken to restore the 2.36 mm sieve % passing gradation for a 9.5 mm HMA surface mixture when it is determined to be greater than the PCS control point value of 47%.

12.3 The Producer shall document the action taken to restore the aggregate degradation value for SMA mixture in accordance with ITM 220 when it is determined to be greater than 3.0%.

12.4 The Producer shall document the action taken to restore the dust/calculated effective binder ratio when it is determined to be greater than 1.4.

12.5 The Producer shall document the action taken to restore the volume of effective binder, Vbe, when it is determined to be less than the design minimum as follows:

Mixture Designation	Minimum Vbe, %
9.5 mm SMA	13.0
12.5 mm SMA	12.0
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

12.6 Moisture Content. The Producer shall take corrective action when the moisture content of the mixture sampled at the HMA Plant exceeds 0.30 percent or

when the moisture content of the surface mixture sampled from the pavement exceeds 0.10 percent.

12.7 The Producer in-line blending SBR latex at the HMA plant shall take corrective action if the latex solids content is more than 0.2% below the lower target limit for more than 15 minutes of production.

12.8 **Documentation.** All corrective action shall be documented in the diary.

13.0 QUALITY CONTROL PLAN.

13.1 Each Producer providing mixture under the Program shall have a written QCP which shall be HMA plant specific and be the basis of control. The QCP shall contain, but not be limited to, the methods of sampling, testing, calibration, verification, inspection, and anticipated frequencies.

13.2 If applicable, the QCP shall include the following information for each HMA Plant:

13.2.1 The location of the HMA Plant site, including the county and reference to the nearest identifiable points such as highways and towns.

13.2.2 The name, telephone number, fax number, email address, duties, and employer of the Management Representative, Certified Asphalt Technician(s), and Qualified Technician(s), if applicable. The duties of all other personnel responsible for implementation of the QCP shall be included.

13.2.3 A list of test equipment that is calibrated or verified, the test methods and frequency of calibration or verification of the equipment, and a statement of accessibility of the laboratory to Department personnel.

If the laboratory is not located at the HMA Plant, the location of the laboratory shall be designated, and the procedure for transporting the mixture to the laboratory included.

13.2.4 A HMA plant site layout diagram which shall include the location of the stockpile area, binder tanks, fuel tank, fiber supply, anti-adhesive supply, field laboratory, visitor parking area, and major components of the mixing HMA plant.

13.2.5 A plan for controls of the aggregate and recycled material stockpiles. Controls for identification of stockpiles by signing or other acceptable methods, techniques for construction of proper stockpiles, and cold bin loading procedures to prevent overflow of material from one bin into another shall be included.

13.2.6 A plan for the identification of the grade of binder in each storage tank and the use of more than one binder grade in a binder tank. The sampling location shall be indicated.

13.2.7 A plan for in-line blending SBR polymer latex at the HMA plant to include a QCP in accordance with ITM 581 as an addendum to the plant QCP

13.2.8 A plan for the production of HMA produced with a water-injection foaming device. The necessary plant modifications, plant production start-up process, planned mixture production temperature ranges, and moisture testing on mixtures sampled at the plant for each DMF shall be included.

13.2.9 The procedure for the consistent uniform addition of baghouse fines when returned into the HMA plant.

13.2.10 The procedure for the consistent uniform addition of fibers into the HMA plant.

13.2.11 The procedure for using an anti-adhesive agent for the truck bed, and a statement that the agent is on the Department's List of Approved Anti-Adhesive Materials.

13.2.12 The procedure for sealing the surge bin when used for extended storage of the mixture up to one working day, and the method to prevent the discharge when the mixture falls below the top of the cone.

13.2.13 The procedure for loading mixture into the trucks.

13.2.14 A sampling plan that includes locations, test methods, devices, techniques, frequencies, and sample reduction procedures.

13.2.15 A testing plan that includes the types of tests, and test methods.

13.2.16 A description of any other process control techniques that may be used. These controls may include, but are not limited to:

a) Different types of material testing

b) Visual checks, and monitoring of HMA plant production

13.2.17 A statement of the procedure for handling addenda to the QCP including a time schedule for submittal.

13.2.18 A documentation plan with details on control charting, test data, and the diary. Copies of the forms may be included.

13.3 The last page of the QCP shall contain two signatures. One signature shall be the Producer Management Representative. The date of submittal and the corporate title of the Producer Management Representative making the signature shall be included. The other signature shall be for approval by the Manager, Office of Materials Management.

13.4 Production of mixture shall not begin before the QCP has been approved. The Producer shall submit two copies of the QCP to the Department for review. One copy shall be submitted to the District Testing Engineer, and one copy to the Office of Materials Management. Acceptance or rejection of the QCP will be made within 15 days of receipt of the QCP. One approved copy will be returned to the Producer.

13.5 The Producer shall transmit all applicable process control changes to the District Testing Engineer for approval. This shall be done in the format of addenda to the QCP. Each page of the QCP that is revised shall include the HMA plant number, date of revision, and means of identifying the revision. The addenda shall be signed and dated by the Management Representative and subsequently signed and dated when approved by the District Testing Engineer.

Revisions for HMA plant major components, Certified Asphalt Technicians, and movement of the HMA plant shall be submitted in the format of a QCP Annex as they occur, and upon approval by the District Testing Engineer shall be included in the Appendix of the QCP. Revisions, other than items on the QCP Annex, shall be maintained on the Addenda Summary sheet in the QCP Appendix.

Addenda may be submitted at the audit close-out meeting or within the first two months of each calendar year. The addenda shall include items on the QCP Annex, items on the Addenda Summary Sheet, and any other necessary revisions at the time of submittal. Upon incorporation into the QCP as addenda, the QCP Annex and items on the Addenda Summary Sheet shall be removed from the QCP Appendix.

13.6 Movement of the HMA Plant to a new location will require an addendum to the QCP. Verification of the calibration of all meters, scales and other measuring devices in accordance with 14.3 shall be completed.

14.0 CERTIFICATION.

14.1 Each Producer requesting to establish a Certified Plant shall do so in writing to the Manager, Office of Materials Management.

14.2 Upon receipt of the request for certification, the District Testing Engineer will be notified to inspect the plant and laboratory.

14.3 A plant inspection, including the correction of any deficiencies and calibration of all meters, scales and other measuring devices to an accuracy within 0.5% throughout their range, shall be completed prior to certification.

14.4 Each HMA plant meeting the requirements of the Program will be certified upon the approval of the QCP.

14.5 The Producer, in accordance with ITM 581, shall submit a written request to the Asphalt Engineer, Office of Materials Management, to in-line blend SBR polymer latex at the HMA plant.

14.6 In the event of a change in ownership of the Certified HMA Plant, the certification shall expire on the date of such change. The new ownership may avoid expiration by submitting a statement to the Manager, Office of Materials Management indicating recognition of the details of the Program, the existing QCP, and a clear pronouncement of intent to operate in accordance with the requirements of both documents prior to providing mixture for the Program.

15.0 DEPARTMENT RESPONSIBILITIES.

15.1 The Department will conduct annual audits on a random basis of each HMA Plant.

15.2 The Department will maintain the List of Approved Certified Hot Mix Asphalt Producers. Producers meeting the requirements of the ASC program for in-line blending of SBR polymer latex will be indicated as a Performance-Graded Asphalt Binder Approved Supplier on the List.

15.3 The Department will administer a Certified Asphalt Technician Training Program for those Asphalt Technicians that perform the required duties for the Certified HMA Plant. Certification of the Technicians will be provided by the Department upon passing a certification test and becoming a Qualified Technician for the test methods designated in the Certified Asphalt Technician Program Procedures and Policies Manual.

15.4 The removal of a Producer from the Department's List of Approved Certified Hot Mix Asphalt Producers will be the responsibility of the Office of Materials Management. The Producer shall have the right to appeal the removal from the Department's List of Approved Certified Hot Mix Asphalt Producers to the Director, Construction Management Division.

HMA QCP ANNEX

Company _____

Plant No. _____

PLANT MAJOR COMPONENT REVISION

Revision:
_____

_____

_____

CERTIFIED ASPHALT TECHNICIAN REVISION

Delete Technician from QCP
_____

Add Technician to QCP
_____

PLANT MOVEMENT

Existing Location:
_____

_____

New Location:
_____

_____

_____

_____ _____ _____ _____
District Testing Engineer Date Management Representative Date

INDIANA DEPARTMENT OF TRANSPORTATION
HOT MIX ASPHALT (HMA) TYPE D CERTIFICATION

CONTRACT NUMBER _____ DATE_____

CERTIFIED HMA PRODUCER
_____

CERTIFIED HMA PLANT NUMBER _____ DMF NUMBER _____

PG BINDER SOURCE _____ PG BINDER GRADE_____

MIXTURE TYPE AND SIZE
_____

DESIGN ESAL _____

Air Voids _____ (from DMF) Binder Content _____ (from DMF)

This is to certify that the test results for Air Voids and Binder Content represent the HMA mixture supplied to this contract.

Air Voids _____ (± 1.5 % from DMF) Binder Content _____ (± 0.7% from DMF)

* [ ] Test results are not available for submittal. A production sample shall be taken within the first 250 t (250 Mg) and each subsequent 1000 t (1000 Mg) for base and intermediate mixtures and each subsequent 600 t (600 Mg) for surface mixtures.

* ✓ If Applicable

_____
Signature of HMA Producer Official

_____
Title of Official

FOR PE/PS USE ONLY

PAY ITEM(S) _____ BASIS FOR USE NO. C999998

SPECIFICATION REFERENCE

__ 304.04 - Patching
__ 304.05 - Widening
__ 402.04 - HMA Pavements
__ 402.07(a) - Rumble Strips
__ 402.07(b) - Wedge & Leveling
__ 402.07(c) - Temporary HMA
__ 503.03(e) - Terminal Joints
__ 507.05(b) - Partial Depth Patching
__ 604.07(c) – Sidewalk
__ 605.07(c) – Curbing
__ 610 - Approaches
__ 610 - Crossovers
__ 718.04 - Underdrains
__ 801.11- Temp. Crossovers

INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT

DELTA Pb (ΔPb) DETERMINATION
FOR DENSE GRADED HMA OR SMA MIXTURES

ITM No. 591-16T

1.0 SCOPE.

1.1 This test method covers the procedure to determine the delta Pb, (ΔPb), which is the difference between the estimated total binder content of the mixture, $(Pb)_{EST}$, and the total binder content as reported on the DMF, $(Pb)_{DMF}$.

The $(Pb)_{EST}$ is derived from the effective binder content of the mixture, Pbe, and an estimate of asphalt binder absorption, $(Pba)_{EST}$.

1.2 The ΔPb determination begins by obtaining the aggregate bulk specific gravity list and instructions as well as any applicable addendums. The mixture type, the aggregate and recycled materials blend percentages, the total binder content and the mixture bulk specific gravity value must also be obtained from the DMF mix-design cover sheet.

1.3 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCED DOCUMENTS.

2.1 AASHTO Standards.

R 35 Superpave Volumetric Design for Hot Mix Asphalt
R 46 Designing Stone Matrix Asphalt (SMA)

2.2 ITM Standards.

584 Bulk Specific Gravity of Aggregate Blends with Recycled Aggregate

2.3 Other References.

SP-2 Superpave Mix Design by Asphalt Institute
Design Mix Formula Cover Sheet

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

4.0 SIGNIFICANCE AND USE. This test method covers the procedure to determine the ΔPb which is the difference between the $(Pb)_{EST}$ and $(Pb)_{DMF}$.

5.0 APPARATUS. The apparatus shall be as stated in the referenced test methods.

6.0 SAMPLING. Sampling shall be as stated in the referenced test methods.

7.0 PROCEDURE.

7.1 Determine the water absorption of the combined aggregates blend as follows:

$(ABS)_{TOTAL} = (ABS_1)(P_1) + (ABS_2)(P_2) + \ldots + (ABS_N)(P_N) + (1.00)[(P_{RAP}) + (P_{RAS}) + (P_{BH}) + (P_{MF})]$

$W(ABS)_{TOTAL}=(ABS_1)(P_1)+(ABS_2)(P_2)+\ldots+(ABS_N)(P_N)+(1.000)[(P_{RAP})+(P_{RAS})+(P_{BH})]$here:

- $(ABS)_{TOTAL}$ = water absorption of the combined aggregates blend
- P_1, $P_{2\ldots}P_N$ = percentages by weight of aggregates 1, 2…N as shown on the DMF cover sheet
- ABS_1, $ABS_{2\ldots}ABS_N$ = water absorption of aggregates 1, 2…N
- P_{RAP}, P_{RAS}, P_{BH}, P_{MF} = percentages by weight of RAP, RAS, Baghouse Fines and Mineral Filler as shown on the DMF cover sheet
- $P_1 + P_2 + \ldots + P_N + P_{RAP} + P_{RAS} + P_{BH} + P_{MF} = 100.0\%$

7.2 Determine the estimated total binder content as follows:

$$(Pb)_{EST} = \frac{(Pbe) + (Pba)_{EST}}{1 + \left[\frac{(Pba)_{EST}}{100}\right]}$$

Where:

$$(Pbe) = \frac{(*VMA - 4.0)}{\left(\frac{Gmb}{1.03}\right)}$$ *use the specification minimum VMA value

$(Pba)_{EST} = (0.50) \times (ABS)_{TOTAL}$ when $(ABS)_{TOTAL} < 1.25\%$
$(Pba)_{EST} = (0.65) \times (ABS)_{TOTAL}$ when $1.25\% \leq (ABS)_{TOTAL} \leq 2.50\%$
$(Pba)_{EST} = (0.80) \times (ABS)_{TOTAL}$ when $(ABS)_{TOTAL} > 2.50\%$

7.3 Determine the ΔPb as follows:

$\Delta Pb = (Pb)_{EST} - (Pb)_{DMF}$

8.0 REPORT. The ΔPb value is reported to the nearest 0.01.

ATTACHMENT 8-4

ADDITIONAL SPECIFICATIONS

A. Coarse Aggregate, No. 43, Base 1
B. PCCP Joints 2
C. Concrete Pavement QC/QA..... 3
D. Joint Sealant…….. 7

COARSE AGGREGATE, NO. 43, BASE

Description

This work shall consist of furnishing and placing a coarse aggregate base to serve as a drainage layer.

Materials

Coarse Aggregate, No. 43, Base shall be in accordance with 904.

Construction Requirements

The construction requirements shall be in accordance with 301, except that in order to prevent segregation, the use of a spreader box to place the base is required.

Compaction shall be in accordance with 302.6 (b).

Basis of Payment

The accepted quantities of coarse aggregate base will be paid for at the contract unit price per ton, complete in place.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
COARSE Aggregate, No. 43, Base	TON

The costs of material, transportation, placing, compacting, and all necessary incidentals shall be included in the cost of the pay item.

PCCP JOINTS

The Standard Specifications are revised as follows:

SECTION 503, DELETE LINE 16, INSERT AS FOLLOWS:

Hot Pour Joint Material…….906.02(a)2.

SECTION 503, BEGIN LINE 49, DELETE AND INSERT AS FOLLOWS:

~~Sawed contraction joints shall be cut in two operations.~~ The ~~initial~~ saw cut shall

SECTION 503, BEGIN LINE 59, DELETE AND INSERT AS FOLLOWS:

The ~~second~~ saw cut shall be made after the concrete has sufficiently cured, but before opening the pavement to non-construction traffic. *The width of the saw cut shall be measured for specification compliance at the time of the sawing operations.* Slurry or saw residue

SECTION 503, BEGIN LINE 78, DELETE AND INSERT AS FOLLOWS:

construction traffic uses the PCCP prior to sealing. *The sawed joint shall be cleaned as specified in 503.05(a).*

SECTION 503, BEGIN LINE 214, DELETE AS FOLLOWS:

~~When preformed elastomeric joint seals are used, the material shall be installed in one continuous piece by means of an approved machine. The seal shall not be stretched more than 5% while being placed and show no twisting, rollover, folding, cutting, or excess lubricant-adhesive on the top of the seal. Elastomeric joint seal may be installed in two separate pieces for phased construction with the splice point occurring at the highest point of the joint. The splicing method used shall be in accordance with the seal manufacturer's recommendations.~~

Quality Control/ Quality Assurance, QC/QA, Portland Cement Concrete Pavement, PCCP

SECTION 501.03, AFTER LINE 32 INSERT THE FOLLOWING:

Silica fume……901.04

SECTION 501.04(a), LINE 48, DELETE AND INSERT AS FOLLOWS:

(g) the specific gravity of ~~pozzolan~~ *each supplementary cementitious material (SCM)*

SECTION 501.04(a), LINE 68, DELETE AND INSERT AS FOLLOWS:

2. ~~pozzolan~~ *SCM* source or type

SECTION 501.04(b), LINES 95 & 96, DELETE AS FOLLOWS:

~~6. increase in cement content from the amount designated in the original CMDP.~~

SECTION 501.05, LINES 117-125 DELETE AND INDERT AS FOLLOWS:

The CMD shall *contain at least one, but no more than two SCM's, and* produce workable concrete mixtures having the following properties:

Minimum ~~portland~~ *total* ~~cement~~ cementitious content *defined by CMDP*……....~~400~~ *500* lbs/cu yd

*Allowable amount of single SCM defined by CMDP, % of total cementitious, by weight...20.0 - 40.0%**

*Allowable amount of two SCM's defined by CMDP, % of total cementitious, by weight.....25.0 – 40.0%***

Minimum portland cement content defined by CMDP……350 lbs/cu yd

Allowable amount of silica fume SCM defined by CMDP, % of total cementitous content….3.0 – 7.0%

Maximum *allowable* water/cementitious ratio of concrete mixture *with fly ash SCM* …..~~0.450~~ *0.440*

Maximum allowable water cementitious ratio of concrete mixture with ggbfs SCM……0.450

~~Minimum portland cement/fly ash ratio .....3.2 by weight~~

~~Minimum portland cement/GGBFS ratio .....2.3 by weight~~

Target air content *defined by CMDP* ..... ~~6.5~~ *7.0%*

Minimum flexural strength, third point loading .....570 psi at 7 days

**For binary binder system that contains fly ash or ggbfs combined with cement*

***For ternary mixes, the amount of fly ash or ggbfs in the binder system shall not be less than 15.0% of the total cementitious defined by the CMDP. Silica fume may be a SCM component of a ternary binder system.*

SECTION 501.05, LINES 146 TO 151, DELETE AND INSERT THE FOLLOWING:

~~Fly ash or GGBFS used as an additive, or blended cements may only be incorporated in the concrete mix between April 1 and October 15 of the same calendar year. If type IP, type IP-A, type IS or type IS-A cements are to be used, the minimum portland cement content shall be increased to 500 lbs/cu yd. The use of fly ash or GGBFS as an additive will not be allowed when blended cement types IP, IP-A, IS, or IS-A are used.~~ *SCM's may be used in concrete for slip-form paving operations without calendar restriction. If a Type IP, IP-A, IS, or ISA blended cement is used in the concrete, the additional use of a SCM, other than silica fume, is not allowed.*

In formed paving operations, fly ash or ggbfs SCM's may only be used in concrete that is placed between April 1 and October 15 of the same calendar year.

Silica fume SCM may be used in slip-formed and formed PCCP without calendar restriction.

If a Type IP, IP-A, IS of ISA blended cement is used in the concrete, the additional use of a SCM, other than silica fume, is not allowed.

SECTION 501.06, LINES 166 - 169, DELETE AND INSERT THE FOLLOWING:

conduct the air content test. The air content shall be ~~5.0~~ *5.5%* to 10.0%. The plastic unit weight shall be within ± 3.0% from the target plastic unit weight of the CMDS. The water/cementitious ratio shall be within ± ~~0.030~~ *0.015* of the target value of the CMDS and shall not exceed ~~0.450~~ *the maximum amount allowed for the appropriate mix in accordance with 501.05*. The flexural strength shall be determined by averaging a

SECTION 501.15, LINES 288-289, DELETE AND INSERT THE FOLLOWING:

when the ambient temperature is 35°F and above~~, unless procedures outlined in the QCP for lower temperatures are followed~~. *If the local forecast predicts an average minimum temperature below 40 °F for 10 consecutive days, the QCP shall provide details prior to the cold weather to address changes in materials, concrete batching and mixing processes, construction methods, curing, and protection of the in situ concrete to insure that the necessary quality characteristics will not be compromised as a result of the cold weather.* Prior to attaining opening to traffic

SECTION 501.23(a). LINES 356-357, DELETE AND INSERT THE FOLLOWING:

Construction vehicles or equipment will be allowed on the PCCP ~~after 10 days or~~ when flexural tests indicate a modulus of rupture of 550 psi or greater. ITM 402

SECTION 501.23(b), LINES 364-367, DELETE AND INSERT THE FOLLOWING:

The PCCP may be opened to traffic ~~after 14 days. The PCCP may be opened earlier if the test beams of ITM 402~~ *when flexural tests* indicate a modulus of rupture of 550 psi or greater. *ITM 402 may be used as an alternate method to determine the flexural strength.* If adequate strengths are not ~~met within 14 days~~ *achieved*, an investigation by the Engineer and Contractor will be conducted to determine if the PCCP is deficient. Resolutions for

SECTION 501.27(b), LINE 518, DELETE AND INSERT THE FOLLOWING:

0.030 of the target value or exceed ~~0.450~~ *the maximum allowed for the appropriate mixture in accordance with 501.05*. A stop paving order will be issued if the

SECTION 501.27(d), LINES 533 – 534, DELETE AND INSSERT THE FOLLOWING:

The average lot air content values shall not vary more than - ~~0.8~~ *1.2*% to + ~~2.4~~ *2.2*% from the ~~6.5~~ 7.0% target air content. The range of sublot air content values shall not

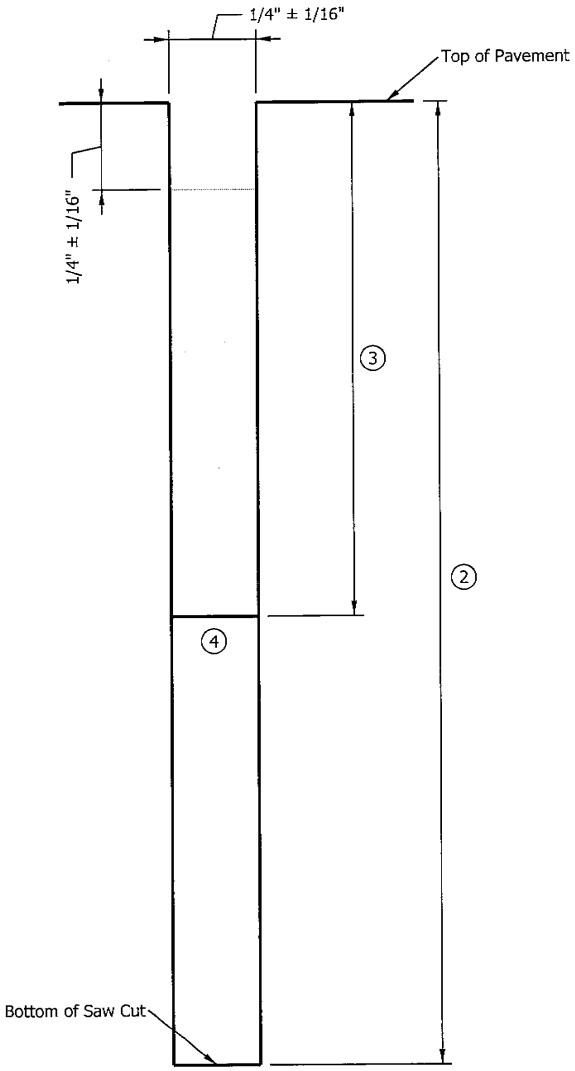
SECTION 501.28(b)1., LINE 606, DELETE AND INSERT THE FOLLOWING:

LOT AVERAGE AIR CONTENT	
Percent, %	Pay Factors
> 9.8	*
9.7 – 9.8	~~0.80~~ *0.85*
9.5 – 9.6	~~0.90~~ *0.95*
9.3 – 9.4	~~0.95~~ *0.99*
~~9.0~~ *5.8* – 9.2	~~0.99~~ *1.00*
5.7 ~~– 8.9~~	~~1.00~~ *0.93*
5.6	~~0.93~~ *0.90*
5.5	~~0.90~~ *0.85*
5.4	~~0.85~~ *0.79*
~~5.3~~	~~0.79~~
< ~~5.3~~ *5.4*	*
* The PCCP will be adjudicated as a failed material in accordance with normal Department practice as listed in 105.03. The PCCP may be subject to removal and replacement or left in place with reduced or no payment.	

LOT RANGE FOR AIR CONTENT	
Percent, %	Pay Factors
0.0 – 2.5	1.00
2.6 – 3.0	0.99
3.1 – 3.5	0.97
> 3.5	*
* The PCCP will be adjudicated as a failed material in accordance with normal Department practice as listed in 105.03. The PCCP may be subject to removal and replacement or left in place with reduced or no payment.	

SECTION 501.28(b)2., LINE 609, DELETE AND INSERT THE FOLLOWING:

If a sublot value is less than ~~5.0~~ *5.5*% or greater than 10.0%, the PCCP will be



SAWED LONGITUDINAL JOINT
WITH HOT POUR SEALANT

NOTES:

1. This detail is to be used in place of Standard Drawing E 503-CCPJ-03.

2. For Longitudinal Joint per 503.03(b), the depth of saw cut shall be D/3 (-0,+3/8"). "D" is identified on Standard Drawing E 503-CCPJ-01 and -02. For Longitudinal Construction Joint per 503.03(d), the depth of saw cut shall be 1".

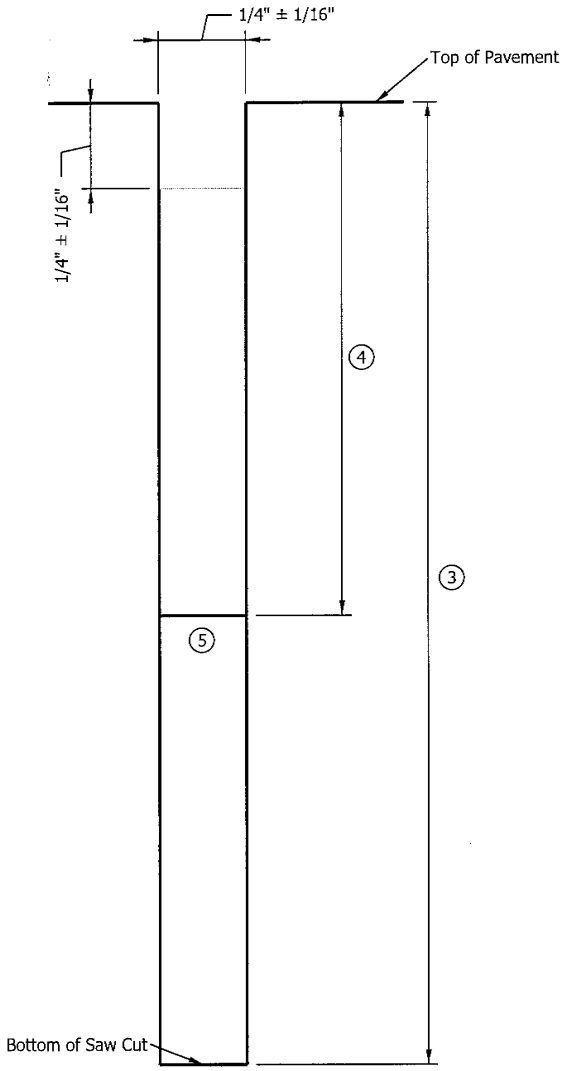
3. For Longitudinal Joint per 503.03(b), the depth of sealant shall be at least 2". For Longitudinal Construction Joint the sealant shall go to the bottom of the 1" saw cut.

4. A backer rod shall not be installed.

INDIANA DEPARTMENT OF TRANSPORTATION

KUMAR P. DAVE
REGISTERED
No.
19400054
STATE OF
INDIANA
PROFESSIONAL ENGINEER

11/10/2015



TYPE D-1 SAWED CONTRACTION JOINT SEALANT

NOTES:

1. This detail is to be used in place of Standard Drawing E 503-CCPJ-06.
2. Transverse joints shall be constructed perpendicular to the centerline with maximum spacing of 18'-0" unless otherwise specified.

(3) The depth of the saw cut shall be D/3 (-0, +3/8") "D" is defined on Standard Drawing E 503-CCPJ-01 and -02.

(4) The depth of sealant shall be at least 2".

(5) A backer rod shall not be installed.

INDIANA DEPARTMENT OF TRANSPORTATION

KUMAR P. DAVE
REGISTERED
No.
19400054
STATE OF
INDIANA
PROFESSIONAL ENGINEER

11/10/2015

ATTACHMENT 8-5

PATCHING LOCATIONS

PATCHING WORKSHEET
SOUTH BOUND
I-65 from S. of US 231 RP 246 +74 to US 30 (RP 252+73)

PARTIAL DEPTH/JOINT						
RP	DIRECTION	LANE	TYPE	LENGTH LF	WIDTH LF	AREA SY
252.3	SB	1	PD	2.00	2.00	0.44
252.3	SB	1/2	Long Joint	30.00	2.00	6.67
252.3	SB	1/2	Long Joint	15.00	2.00	3.33
252.3	SB	1/2	Long Joint	30.00	2.00	6.67
252.3	SB	1/2	Long Joint	95.00	2.00	21.11
252.3	SB	2	PD	2.00	2.00	0.44
252.3	SB	1/2	Long Joint	73.00	2.00	16.22
252.2	SB	1/2	Long Joint	18.00	2.00	4.00
252.2	SB	1	PD	2.00	2.00	0.44
252.2	SB	1	PD	2.00	2.00	0.44
252.2	SB	2	PD	2.00	2.00	0.44
252.2	SB	1	PD	2.00	2.00	0.44
251.0	SB	2	PD	2.00	2.00	0.44
252.0	SB	1/2	Long Joint	18.00	2.00	4.00
252.0	SB	3	PD	4.00	1.00	0.44
252.0	SB	2	PD	3.00	2.00	0.67
251.9	SB	1/2	Long Joint	73.00	2.00	16.22
251.9	SB	3	PD	2.00	12.00	2.67
251.9	SB	3	PD	2.00	12.00	2.67
251.9	SB	2	PD	4.00	2.00	0.89
251.9	SB	3	PD	4.00	2.00	0.89
251.9	SB	3	PD	4.00	2.00	0.89
251.9	SB	3	PD	2.00	3.00	0.67
251.8	SB	3	PD	2.00	12.00	2.67
251.8	SB	3	PD	2.00	12.00	2.67
251.8	SB	3	PD	2.00	12.00	2.67
251.8	SB	3	PD	2.00	5.00	1.11
251.8	SB	3	PD	2.00	2.00	0.44
250.6	SB	1	PD	2.00	2.00	0.44
250.3	SB	OS	PD	2.00	2.00	0.44
250.3	SB	OS	PD	2.00	2.00	0.44
250.1	SB	2	PD	2.00	2.00	0.44
250.1	SB	DL	PD	2.00	2.00	0.44
TOTAL						**102.89**

PATCHING WORKSHEET
SOUTH BOUND
I-65 from S. of US 231 RP 246 +74 to US 30 (RP 252+73)

FULL DEPTH						
RP	DIRECTION	LANE	TYPE	LENGTH LF	WIDTH LF	AREA SY
252.3	SB	3	FD	6.00	12.00	8.00
252.3	SB	3	FD	6.00	12.00	8.00
252.2	SB	3	FD (at joint)	12.00	12.00	16.00
252.1	SB	3	FD (Joint)	12.00	12.00	16.00
252.1	SB	3	FD (T-Joint)	2.00	12.00	2.67
252.1	SB	3	FD (T-Joint)	2.00	12.00	2.67
252.1	SB	3	FD (T-Joint)	2.00	12.00	2.67
252.0	SB	3	FD	77.00	12.00	102.67
251.9	SB	3	FD	12.00	12.00	16.00
251.8	SB	2	FD (Joint)	12.00	12.00	16.00
251.4	SB	2	FD	73.00	12.00	97.33
250.3	SB	2	FD	75.00	12.00	100.00
249.7	SB	off ramp	FD	20.00	12.00	26.67
249.7	SB	Gore	FD	40.00	6.00	26.67
249.5	SB	2	FD	32.00	12.00	42.67
249.5	SB	2	FD	36.00	12.00	48.00
249.3	SB	2	FD	43.00	12.00	57.33
249.3	SB	2	FD	76.00	12.00	101.33
249.2	SB	2	FD	149.00	12.00	198.67
249.2	SB	2	FD	47.00	12.00	62.67
249.2	SB	2	FD	8.00	12.00	10.67
249.2	SB	2	FD	23.00	12.00	30.67
249.1	SB	OS	FD	58.00	12.00	77.33
249.0	SB	2	FD	40.00	12.00	53.33
248.3	SB	2	FD	70.00	12.00	93.33
248.1	SB	2	FD	74.00	12.00	98.67
247.9	SB	1	FD	6.00	12.00	8.00
247.2	SB	2	FD	68.00	12.00	90.67
247.2	SB	2	FD	42.00	12.00	56.00
246.7	SB	1	FD	30.00	12.00	40.00
TOTAL						**1510.67**

PATCHING WORKSHEET
NORTH BOUND
I-65 from S. of US 231 RP 246 +74 to US 30 (RP 252+73)

PARTIAL DEPTH/JOINT						
RP	DIRECTION	LANE	TYPE	LENGTH LF	WIDTH LF	AREA SY
247.7	NB	DL	PD	2.00	3.00	0.67
247.7	NB	DL	PD	2.00	3.00	0.67
247.7	NB	PL	PD	2.00	2.00	0.44
247.7	NB	PL	PD	2.00	2.00	0.44
247.7	NB	PL	PD	2.00	2.00	0.44
247.7	NB	DL	PD	1.00	4.00	0.44
247.8	NB	DL	PD	1.00	3.00	0.33
248.4	NB	DL	PD	4.00	1.00	0.44
248.4	NB	PL	PD	2.00	2.00	0.44
249.3	NB	DL	PD	3.00	3.00	1.00
252.0	NB	DL,AUX	PD	112.00	2.00	24.89
TOTAL						**30.22**

PATCHING WORKSHEET
NORTH BOUND
I-65 from S. of US 231 RP 246 +74 to US 30 (RP 252+73)

FULL DEPTH						
RP	DIRECTION	LANE	TYPE	LENGTH LF	WIDTH LF	AREA SY
249.6	NB	DL	FD	32.00	12.00	42.67
248.2	NB	DL	FD	75.00	12.00	100.00
249.2	NB	DL	FD	32.00	12.00	42.67
249.2	NB	DL	FD	18.00	12.00	24.00
249.5	NB	DL	FD	82.00	12.00	109.33
249.2	NB	DL	FD	110.00	12.00	146.67
249.7	NB	DL	FD	68.00	12.00	90.67
249.7	NB	DL	FD	76.00	12.00	101.33
250.2	NB	DL	FD	204.00	12.00	272.00
250.2	NB	OS	FD	18.00	12.00	24.00
250.4	NB	DL	FD	39.00	12.00	52.00
250.4	NB	DL	FD	25.00	12.00	33.33
250.5	NB	DL	FD	110.00	12.00	146.67
251.8	NB	DL	FD	30.00	12.00	40.00
251.9	NB	DL,AUX	FD	38.00	24.00	101.33
TOTAL						**1326.67**

ATTACHMENT 9-1

UNIQUE SPECIAL PROVISIONS

Drainage

A. Cured-in-Place Thermosetting Resin Pipe Liner (CIPP)

CURED-IN-PLACE THERMOSETTING RESIN PIPE LINER (CIPP)

Description

This work shall consist of the fabrication, installation, and curing of a tight-fitting, resin-impregnated fabric, cured-in-place pipe liner, hereinafter referred to as CIPP, into existing circular or deformed pipe structures in accordance with 105.03.

Materials

CIPP shall be in accordance with ASTM D 5813, Type III, grade 1, 2, or 3, and shall be UV and abrasion resistant. The manufacturer shall determine the proper grade of the CIPP to be used under the installation and operation conditions that will exist for the location in which the CIPP is to be used. CIPP shall be designed in accordance with ASTM F 1216 and appendix X1 for a fully deteriorated condition.

Construction Requirements

Maintenance of Drainage

Drainage shall be maintained during the installation and curing operations in a manner that does not damage adjacent property.

Pre-Installation Requirements

Before beginning the CIPP installation operation, three copies of design calculations shall be submitted to INDOT. The design calculations shall be sealed by a registered professional engineer in the state of Indiana and shall certify:

1. the proposed CIPP thickness was determined in accordance with ASTM F 1216;

2. the required curing pressure; and

3. the proposed waterway opening is in accordance with the plans.

Prior to installing the CIPP, a video inspection of the structure shall be performed. This inspection is to identify cavities in the structure that need to be repaired, identify connecting structures that shall be perpetuated, etc. The video shall become the property of the Department. Cavities adjacent to the existing structure shall be filled in accordance with 725.05. Existing jagged edges or other deformities that impact the CIPP operation or function shall be repaired in accordance with the manufacturer's recommended procedures. All foreign material shall be removed from the existing structure in accordance with the ASTM specifications for the installation method and disposed of in accordance with 203.10.

Installation Requirements

CIPP shall be installed by the inversion method or the pulled-in-place method. Inversion installation of the CIPP shall be in accordance with ASTM F 1216. Pulled-in-place installation of the CIPP shall be in accordance with ASTM F 1743.

If the Design-Build Contractor elects to use polyester resin, all condensate water and all water in contact with the inside or outside of the CIPP during the curing process and until the CIPP has cooled to ambient temperature shall be collected and tested for styrene concentration levels.

If the level of styrene concentration is equal to or greater than 100 parts per billion (0.1 mg/L), the contaminated water shall be disposed of at an appropriate disposal facility.

Cured CIPP shall be inspected and videotaped for workmanship. Defects in workmanship as defined in ASTM D 5813 section 6.2 shall be repaired or the CIPP shall be replaced so it meets the requirements of these specifications. The repaired or replaced CIPP shall be re-videotaped. The video tape shall become the property of the Department. The installed CIPP shall be tested for delamination in accordance with the appropriate ASTM specification. The cured CIPP shall be cut within 6 inches of the ends of the existing structure. Where beveled inlets are required, the details shown in the plans shall be followed. Existing connections, including underdrains or another pipe structure, to the structure to be lined shall be perpetuated through the CIPP.

The CIPP shall be permanently marked with a stainless steel label with a minimum thickness of 0.080 inch located above the structure low water elevation and within 6 inches of the structure end. The information shown on the label shall be at least ½ inch tall and include the month and year of installation, the CIPP source, and the ASTM material specifications.

QC/QA Procedure

For each existing structure lined, a Type A certification in accordance with 916 and a test report in accordance with ASTM D 5813, section 7.3 shall be submitted.

An independent laboratory shall test field-cured samples from each CIPP installation. Appropriate documentation for the independent laboratory shall be provided prior to installation of the CIPP. Testing results shall be provided to INDOT within 7 days of receipt.

At each structure to be lined, two flat plate samples shall be field cured and submitted for testing. The samples shall be taken directly from the wet out tube, clamped between flat plates and cured in the downstream end of the tube. As an alternative, two restrained end samples may be used for CIPPs installed in pipes between 8 and 18 inches in diameter, or equivalent. The field-cured samples shall be submitted to the laboratory within 3 days of the completion of the installation.

The field-cured samples shall be conditioned, prepared, and tested in accordance with ASTM D 5813. The wall thickness and flexural tests need only be performed on the structural portion of the CIPP only.

ATTACHMENT 9-2

RECURRING SPECIAL PROVISION
STORM WATER MANAGEMENT

(Note: Proposed RSP 205-R-xxx STORM WATER MANAGEMENT
revises currently used RSP
205-R-621 QUALITY CONTROL TEMPORARY EROSION AND SEDIMENT CONTROL,
effective for letting on or after 01/01/2016.
Basis for Use: *May only be used on contracts selected by Mark Miller and John Wright.*
Copy of the RSP 205-R-621 is shown here as a BACKUP 01 to this item.
Changes to ITM 803 pending.)

205-R-xxx STORM WATER MANAGEMENT

(Adopted xx-xx-16)

The Standard Specifications are revised as follows:

SECTION 101, AFTER LINE 33, INSERT AS FOLLOWS:

BMP	*best management practice*
CESSWI	*Certified Erosion Sediment and Storm Water Inspector*
CISEC	*Certified Inspector of Sediment and Erosion Control*
CPESC	*Certified Professional in Erosion and Sediment Control*
NOI	*Notice of Intent*
NOT	*Notice of Termination*
RECP	*rolled erosion control product*
SWQCP	*Storm Water Quality Control Plan*
SWQM	*Storm Water Quality Manager*

SECTION 108, DELETE LINES 114 THROUGH 219.

SECTION 108, AFTER LINE 219, INSERT AS FOLLOWS:

For those contracts requiring IAC 327 15-5, having waterway permits, and storm water management, the Contractor shall locate, install, maintain and remove temporary sediment and erosion control BMPs, for earth disturbing activity areas, and develop a SWQCP, for the Engineer's acceptance, in accordance with 205.

Where required by IAC 327 15-5, stockpile and storage sites shall be permitted by an IDEM Notice of Intent, NOI. The Contractor shall submit a new NOI for all off-site borrow and waste sites. A copy of the new NOI shall be submitted to the Engineer prior to the beginning of operations at those locations. Borrow and disposal sites shall be in accordance with 203.08.

For those contracts not requiring IAC 327 15-5, having no waterway permits, and not requiring storm water management, the contractor shall submit a written site plan to the Engineer describing the following:

1. *A description of the contract site.*
2. *The locations of all equipment storage areas, fueling locations, construction trailers, batch plants, and designated concrete truck washout locations.*
3. *A material handling and spill prevention plan.*

FINAL DRAFT MINUTES

The site plan shall be submitted for acceptance 14 calendar days prior to the start of construction activity.

The cost of preparation and implementation of the site plan described above shall be included in the cost of the other items of the contract.

SECTION 108, BEGIN LINE 243, DELETE AS FOLLOWS:

~~The cost of preparation of the erosion control plan shall be included in the cost of the erosion and sediment control items.~~

SECTION 109, BEGIN LINE 808, DELETE AND INSERT AS FOLLOWS:

~~(g) Erosion and Sediment Control, E&SC~~*Storm Water Management*

Quality adjustments will be calculated in accordance with 205.08.

SECTION 205, DELETE LINES 1 THROUGH 516.

SECTION 205, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 205 - STORM WATER MANAGEMENT

205.01 Description

This work shall consist of furnishing, installing, maintaining, and removing storm water management measures in accordance with the Department's Design SWPPP, the submitted and accepted Contractor developed SWQCP, and 105.03.

MATERIALS

205.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class F or Higher 904
Fertilizer.....914.03(a)
Filter Sock.....914.09(h)
Geotextile 918
Grass Seed, Temporary.....914.02
Manufactured Surface Protection Products.....205.04(c)
Metal End Sections.....908.06
Mulch.....914.05(a)
Pipe Drains .....715.02(d)
Plastic Net .....914.09(g)
*Revetment Riprap 904**
Stakes.....914.09(b)
Staples .....914.09(f)
Top Soil 914.01
Water .....914.09(a)

FINAL DRAFT MINUTES

**The minimum depth does not apply. Straw bales shall not weigh less than 35 lb. Bales shall be bound with wire or nylon twine.*

CONSTRUCTION REQUIREMENTS

205.03 General Requirements

The Contractor shall locate, install, maintain and remove storm water management control BMPs for earth disturbing activity areas, and develop a SWQCP, in accordance with IAC 327 15-5. The Contractor's SWQCP shall be a required contract specific component to the Department's Design SWPPP. The submitted and accepted Contractor's SWQCP and the Department's Design SWPPP shall work in coordination with each other to complete the requirements of IAC 327 15-5.

(a) Storm Water Quality Control Plan Development

The Contractor's SWQCP shall be developed by a professional engineer who holds a current CPESC or CPESC In-Training certification or approved equivalent. The SWQCP developer shall be familiar with the project site and be able to develop the SWQCP in accordance with the site conditions. In the event of conflict between requirements, pollution control laws, rules, or regulations of other Federal, State or local agencies, the Contractor's SWQCP shall adhere to the more restrictive laws, rules, or regulations. The SWQCP developer shall issue clarifications, correct errors and omissions, and revise the SWQCP as required. The Contractor's SWQCP shall be stamped by the SWQCP developer as defined above.

The Contractor shall develop the project SWQCP for all applicable storm water management measures in accordance with 327 IAC 15-5, Chapter 205 of the Indiana Department of Transportation Design Manual, the IDEM "Indiana Storm Water Quality Manual", ITM 803, and all other applicable contract documents.

The Contractor's SWQCP shall incorporate all narrative information, plan sheets, and implementation information necessary for storm water management utilized for the project. The SWQCP shall include any revisions to the Department's Design SWPPP and the plans to comply with all known permit requirements applicable to the construction phase of the project included in the NOI, 401 and 404 permits, and all other permits as well as those required by the Contractor in accordance with 107.01 and 205.03(c).

A copy of the Contractor's offsite operations NOI for items such as offsite stockpiles, borrow sites, waste sites, or storage areas shall be submitted to the Engineer prior to operations at those sites.

Electronic files of any plan sheets and narratives shall be provided in .pdf format.

The Contractor may elect to prepare and submit the SWQCP in multiple phases. The first phase of the SWQCP shall show the location, installation, and maintenance of storm water

FINAL DRAFT MINUTES

management BMPs for the existing topography of the project during clearing activities and prior to earth disturbing activities for the remaining construction. The first phase of the SWQCP shall be submitted prior to subsequent phases. Additional phases shall show the progression from the existing topography to the final grade and shall be submitted for review prior to earth disturbing activity for that phase. Each phase of the SWQCP shall be modified to meet existing field conditions as needed.

If a governmental agency or a local governmental authority finds a violation of NPDES or any other surface water permits provided in the bid documents, or any BMPs are incomplete, or the Contractor's SWQCP is incomplete, full responsibility shall be borne by the Contractor to make corrections. In addition if an assessment, damage judgment or finding, agreed order, fine, or any other expense for a violation of the contract requirements is leveled against the Department, the Contractor shall reimburse the State for that amount within 30 days. The Contractor agrees to indemnify and hold harmless the Department and will reimburse the Department for any assessments, damage judgments or finding, fine, penalty or other expense relating to this portion of the contract. The Department may withhold the amount owed from the Contractor's subsequent pay estimates. Delays caused by stop work orders from regulatory agencies, suspension of work orders from the Department, or any other delays caused by inadequate submittals or implementation will be considered Non-Excusable Delays in accordance with 108.08(c).

(b) Storm Water Quality Manager

The Contractor shall designate one person as the contract SWQM. The designated individual shall be trained as a level 1 or level 2 SWQM as indicated within the contract documents. The SWQM training level shall meet or exceed the level required within the contract documents.

1. Level 1 SWQM

A level 1 SWQM shall have successfully completed the Department's Construction Storm Water Training course and hold a current training verification document for that course.

2. Level 2 SWQM

A level 2 SWQM shall meet the requirements of 205.03(b)1, and hold a current certification as a CESSWI, or a CESSWI In-Training, or a CISEC, or a CISEC In-Training, or a CPESC, or a CPESC In-Training, or an approved equivalent.

The SWQM shall be responsible for ensuring that the Contractor's SWQCP has been submitted for review prior to implementation. The SWQM shall also be in responsible charge of the implementation of the Contractor's SWQCP. Implementation of the SWQCP includes installation, maintenance, and removal of all storm water management measures. The SWQM shall also be in responsible charge of the weekly and post-event inspections. The inspections shall be documented using the Storm Water, Erosion, and Sediment Control Inspection Report

FINAL DRAFT MINUTES

form. The copy of the form is available on the Department's website or provided by the Engineer.

The SWQM shall attend the pre-construction conference and at least one contract scheduling meeting per calendar month. The SQWM shall accompany personnel from IDEM or other governmental agencies, as required, during site visits by those agencies. The name of the SWQM shall be furnished to the Engineer at, or prior to, the pre-construction conference. If the designated individual is replaced during the contract, the replacement shall be designated, and notification given to the Engineer within 24 hours.

(c) Storm Water Quality Control Plan Content

The Contractor's developed SWQCP shall include the processes and procedures of how the Contractor intends to meet the requirements as outlined in this section and in accordance with ITM 803, Contractor Quality Control Plan for Storm Water.

Any individual phase of the SWQCP shall be submitted to the Engineer for review a minimum of 14 calendar days prior to commencing earth disturbing activities for that phase. Upon receipt, the Engineer will perform a review of the submitted phase of the SWQCP within 14 calendar days for acceptance.

At a minimum, the SWQCP shall include the following:

1. *Description of the site.*

2. *Locations of all proposed top soil stockpiles.*

3. *Locations of all proposed equipment storage areas, fueling locations, construction trailers, batch plants, and designated concrete truck washout areas.*

4. *Proposed construction sequence and phasing of storm water management measures including plans for installation, maintenance, and removal of BMPs.*

5. *Locations and design flow from offsite areas that drain onto project limits. The SWQCP design shall include BMPs properly sized and placed to accommodate runoff from outside of the project limits and the drainage quantity from within the project limits.*

6. *Locations of all construction entrances where vehicles and equipment will enter and exit the site.*

7. *Material handling and spill prevention plan.*

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8. *Statements that the storm water management measures for the project shall, at a minimum, be inspected on a weekly basis and within 24 h of every 1/2 in. rain event.*

9. *Provisions to ensure that pollutants such as fuels, lubricants, asphalt, sewage, wash water, or waste from concrete mixing operations, and other harmful materials shall not be discharged into existing bodies of water.*

10. *Provisions to ensure that all applicable regulations and statutes relating to the prevention and abatement of pollution shall be complied with in the performance of the contract.*

11. *Statements that all appropriate storm water management items shall be in place prior to disturbing the project site.*

When Waters of the United States are located within the project limits the following shall also be addressed in the SWQCP:

1. *A method for delineating the boundaries of the Waters of the United States as shown on the plans.*

2. *A method for conducting work located in or adjacent to bodies of water, and how the work in those locations shall be conducted in compliance with all conditions within the project 401, and 404 permits.*

(d) Temporary Storm Water Management Features

Temporary storm water management measures shall be placed as soon as practicable. Perimeter protection and sediment traps shall be installed prior to beginning earth disturbing activities. Pipe end sections and anchors shall be installed when the structure is installed. If the pipe end sections or anchors cannot be placed at the same time, temporary riprap splashpads shall be placed at the outlets of the pipes until end sections or anchors can be installed.

Adjustments of the storm water management measures shall be made to satisfy field conditions and shall be subject to the Engineer's approval. Adjustments made to meet field conditions shall be made as soon as practicable and shall be maintained as necessary.

The Contractor shall provide a stable construction entrance at the points where construction traffic will enter onto an existing road. Where there is insufficient space for a stable construction entrance, other measures shall be taken to prevent the tracking of sediment onto the pavement. These temporary entrances shall be the responsibility of the Contractor to completely install, maintain, and remove.

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The Contractor shall provide concrete washout facilities of adequate capacity in accordance with project requirements. The concrete washout shall be located as far from surface waters as practical, and shall be able to contain all liquid and solid material from concrete truck or mixer washing operations without contacting or contaminating the ground.

The installation of storm water management measures shall include those necessary or required by permits at off-site locations such as borrow and disposal areas, field office sites, batch plants, locations where the Contractor's vehicles enter and leave public roads, and other locations where work pertaining to the contract is occurring. The Contractor's SWQM shall be responsible for the installation, inspection, and maintenance of these measures.

The Contractor shall employ dust control measures in accordance with 107.08(b).

(e) Permanent Storm Water Management Features

Permanent storm water management measures shall be incorporated into the work at the earliest practicable time.

205.04 Temporary Surface Stabilization

Non-vegetated areas shall be temporary stabilized if the area remains inactive for more than seven days. The area will be considered inactive when no meaningful work toward accomplishing a pay item has been performed at a site of disturbed soil. Stabilization methods shall be as shown in the SWQCP.

(a) Seed

Temporary seeding shall be placed on disturbed areas that are expected to be inactive for more than seven days, or as agreed to by the Contractor and the Engineer. Seed shall be placed either by drilling in, spraying in a water mixture, or by use of a mechanical method which places the seed in direct contact with the soil. Where inaccessible to mechanical equipment, or where the area to be seeded is small, a hand operated cyclone seeder or other approved equipment may be used. Seed shall not be covered more than 1/2 in. Seed may be distributed by a drill seeder, cyclone seeder, hand or other approved equipment which allows for even distribution of the seed. If as a result of a rain event, the prepared seed bed becomes rutted, crusted or eroded, or depressions exist, the soil shall be reworked until it is smooth. Reworked areas shall be re-seeded. All seeded areas shall be mulched within 24 h after seeding.

Temporary seed shall be used for surface stabilization and temporary ground cover. Temporary cover mixtures shall be placed and be subject to seasonal limitations as defined herein. This mixture is not intended to be used as a permanent seed mixture. This mixture shall not be used to satisfy the requirements of the warranty bond.

The mix shall be spray mulched where the slope is steeper than 3:1. From June 16 through August 31, mulching alone shall be used to stabilize the soil.

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(b) Spring Mix

Spring mix shall be used from January 1 through June 15. This mixture shall be applied at the rate of 150 lb/ac. The mix shall consist of oats.

(c) Fall Mix

Fall mix shall be used from September 1 through December 31. This mixture shall be applied at the rate of 150 lb/ac. This mix shall consist of winter wheat.

Unless otherwise indicated in the SWQCP, fertilizer shall be spread uniformly over the area to be seeded and shall be applied at 1/2 the rate shown in 621.05(a). Fertilizer shall only be applied during the active growing season March through November.

(d) Mulch

Mulch shall be applied uniformly in a continuous blanket at the rate of 2.5 t/ac. If seeded, mulch shall be placed within 24 h after seeding. The percent of moisture in the mulch shall be determined in accordance with 621.14(c).

Mulch shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally to the slope. The tools used for punching purposes shall be disks that are notched and have a minimum diameter of 16 in. The disks shall be flat or uncupped. Disks shall be placed a minimum of 8 in. apart. Shaft or axle sections of disks shall not exceed 8 ft in length.

The disk for punching shall be constructed so that weight may be added or hydraulic force may be used to push puncher into the ground. An even distribution of mulch shall be incorporated into the soil.

On a slope of 3:1 or steeper but flatter than 2:1, or where specified, temporary mulch stabilization shall also be used. Unless otherwise specified, the following types may be used.

1. Type A

The mulch shall be held in place by means of commercially produced water borne mulch binder product. The product shall be manufactured and used in accordance with all applicable State and Federal regulations. Such product shall be applied in accordance with the manufacturer's written instructions. A copy of the written instructions shall be supplied to the Engineer prior to the seeding work. The product shall include a coverage indicator to facilitate visual inspection for evenness of application. If the mulch fails to stay in place, the Contractor shall repair all damaged areas.

2. Type B

The mulch shall be held in place with binder twine fastened down with wooden pegs not less than 6 in. long spaced 4 ft apart. The twine shall be placed parallel to and also at 60° to the pavement edge in both directions. The distance between the intersections of the diagonal strands

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measured along the strands shall be 12 ft. The strand parallel to the pavement shall cross the diagonal strands at their intersections to form equilateral triangles of 12 ft on a side.

3. Type C

The mulch shall be held in place with a polymeric plastic net. The plastic net shall be unrolled such that it lays out flat, evenly, and smoothly, without stretching the material. The plastic net shall be held in place by means of staples. The staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be spaced not more than 4 ft apart with rows alternately spaced. The plastic net shall be secured along the top and bottom of the soil slope with staples spaced not more than 1 ft on center. The ends and edges of the plastic net shall be overlapped approximately 4 in. and stapled. Overlaps running parallel to the slope shall be stapled 1 ft on center and overlaps running perpendicular to the slope shall be stapled at least 3 ft on center. The plastic net shall be placed with the length running from top of slope to toe of slope, or the plastic net shall be placed with the length running horizontally or parallel to the contour.

On a slope of 2:1 or steeper, or where specified, a manufactured surface protection product shall be used.

(c) Manufactured Surface Protection Products

The following manufactured surface protection products may be used for covering an area that has not been seeded. Soil cover shall not be used to cover seeded areas. Prior to placing the manufactured surface protection product, the area to be covered shall be free of all rocks or clods of over 1 1/2 in. in diameter, and all sticks or other foreign material, which prevent the close contact of the blanket with the seed bed.

After the area has been properly shaped, fertilized, and seeded, the manufactured surface protection product shall be laid out flat, evenly, and smoothly, without stretching the material.

1. Excelsior Blanket

An excelsior blanket may be used as mulch for seeding where seeding is specified or where erosion control blanket is specified. Excelsior blankets shall be placed within 24 h after seeding operations have been completed. Excelsior blankets shall be installed in accordance with the manufacturer's recommendation.

2. Straw Blanket

A straw blanket may be used as mulch for seeding where mulched seeding is specified or where erosion control blanket is specified. Straw blankets shall be placed within 24 h after seeding. The straw blanket shall be unrolled over the designated area so that the plastic mesh is on top and the straw fibers are snugly and uniformly in contact with the soil surface. The rolls shall be butted together and stapled in place. The staples shall be driven through the blanket at a 90° angle to the plane of the ground surface. Each staple shall anchor the plastic mesh. The staples shall be spaced per the manufacturer's recommendation.

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For placement on a slope, the straw blankets shall be placed with the length running from the top of slope to the toe of slope and shall extend a minimum of 3 ft over the crown of the slope. The blanket shall be stapled in accordance with the manufacturer's recommendation.

For placement in ditch lines, the straw blanket shall be unrolled parallel to the centerline of the ditch. The blanket shall be placed so that there are no longitudinal seams within 24 in. of the bottom centerline of the ditch. In a ditch line, the blanket shall be stapled in accordance with the manufacturer's recommendation with a minimum of six staples across the upstream end of each roll.

3. Rolled Erosion Control Products

The Contractor shall use degradable RECPs including netting, open weave textile, and erosion control blankets.

Seed shall be applied in accordance with 621 unless soil infilling is required.

If soil infilling is required, RECP shall be first installed and then seed applied and brushed or raked 1/4 to 3/4 in. of topsoil into voids in the RECP filling the full product thickness. Staples of at least 6 in. in length shall be used to secure the RECP. The RECP shall be unrolled parallel to the primary direction of flow and placed in direct contact with the soil surface. RECP shall not bridge over surface inconsistencies. Edges of adjacent RECP shall be overlapped by 2 to 4 in. Staples shall be placed to prevent seam separation in accordance with the manufacturer's recommendations.

4. Geotextile

Disturbed soil shall be covered with geotextile. The covering shall be placed over the exposed soil in a shingle like fashion with a 2 ft minimum overlap covering all loose or disturbed soil. The geotextile, if new, shall be in accordance with 918.02. The geotextile used for soil covering need not be new but shall not have holes or unrepaired rips or tears. All repairs shall be made in accordance with the manufacturer's recommendation.

205.05 Concentrated Flow Protection

(a) Check Dam

Check dams and modified check dams shall be constructed as shown on the plans. Geotextile for check dams shall be in accordance with 616 unless otherwise specified. Temporary revetment riprap shall be in accordance with 616. No. 5 and No. 8 filter stone shall be in accordance with 904.

(b) Check Dam, Traversable

Traversable check dams shall be composed of straw bales, 8 in. minimum diameter fiber rolls, or 8 in. minimum diameter socks filled with straw, ground wood chips, shredded bark, or

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other approved material for site specific conditions. Rolls and socks may be stacked in a triangle pattern as shown on the plans. Check dams shall be staked as shown on the plans or as directed by the manufacturer. Check dams shall be configured to eliminate gaps between sections. Straw bales shall be placed such that the bindings are parallel to and not in contact with the ground.

(c) Diversion Interceptors

Grading for diversion interceptors shall be in accordance with 203 with the exception that compaction requirements will not apply. The Contractor shall identify the construction areas which shall utilize diversion type A or B. Slope drains shall be provided at the low points of the diversion interceptor. Perimeter diversion, type C shall be installed prior to earth moving activities and shall be immediately stabilized. Type A or B shall be stabilized if anticipated to be left in place for more than seven calendar days.

(d) Sediment Traps

Sediment traps shall be constructed with revetment riprap, filter stone and geotextile.

(e) Sediment Basins

Embankment construction shall be in accordance with 203. Temporary revetment riprap used for overflow protection shall be in accordance with 904, unless otherwise indicated in the SWQCP. Sediment basins shall be constructed as shown on the plans, or as indicated in the SWQCP. Sediment basins shall be designed to provide a minimum storage volume to contain the runoff from a 10 year 24 h storm event.

(f) Slope Drains

Slope drain pipes shall be lengthened as required due to the construction of the embankment.

(g) Vegetative Filter Strips

Designated vegetative filter strips shall not be disturbed. Small rills that form shall be repaired. Fertilizer shall be applied as indicated in the SWQCP.

(h) Splashpads

Splashpads shall be constructed with revetment riprap with geotextile.

(i) Inlet Protection

All deck and curb drains shall have sediment control measures when the structure or road is to be used for hauling operations or adjacent to disturbed areas. Copies of all current manufacturers' installation manuals shall be provided prior to installation.

205.06 Perimeter Protection

(a) Silt Fence

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Shipping, handling and storage shall be in accordance with the manufacturer's recommendations. The silt fence material shall be in accordance with 918.04. The silt fence material will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, storage, or installation. Each roll shall be labeled or tagged to provide product identification.

Joints shall be made from the ends of each section of fence wrapped around a wood stake and joined together or other method recommended by the manufacturer. Copies of all current manufacturer manuals shall be provided prior to installation.

(b) Filter Berm

Filter berms shall be constructed of organic mulch, filter sock, or No. 5 and No. 8 filter stone.

205.07 Maintenance

Storm water management measures shall be inspected, at a minimum, once every seven days and after a 1/2 in. rain event. Inspections shall be documented and records shall be maintained by the Contractor, to be submitted to the Engineer on the next business day following the inspection. The temporary protection measures shall be remedied within 48 h after inspection or as directed. The Contractor shall rebuild or repair damaged storm water management measures.

If conditions do not allow the Contractor access to the location of the storm water management features using normal equipment and maintenance, the Contractor shall submit to the Engineer an acceptable written alternate schedule, within 48 h, to bring the storm water management features back into compliance.

(a) Silt Fence

If the fence fabric tears, starts to decompose, or becomes ineffective, the affected portion shall be replaced. Deposited sediment shall be removed once it reaches 1/2 the height of the fence at its lowest point. Once the contributing drainage area has been stabilized, the Contractor shall remove the fence and sediment deposits, grade the site to blend with the surrounding area, and stabilize the graded area.

(b) Sediment Basin

Sediment shall be removed once it has accumulated to 1/2 the design volume. The filter stone around the riser pipe shall be replaced if the sediment pool does not drain within 72 h following a stormwater runoff event.

(c) Filter Berm

Accumulated sediment shall be removed once it reaches 1/4 of the height of the filter berm. The filter berm shall be inspected to ensure that it is holding its shape and allowing adequate flow. Eroded and damaged areas shall be repaired.

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(d) Inlet Protection

Accumulated sediment shall be removed once identified and after each storm event. Flushing with water will not be allowed. The sediment shall not be allowed to re- enter the paved area or storm drains. Curb inlet inserts shall be cleaned in accordance with the manufacturer's recommendations.

(e) Sediment Traps

Following each storm event, the Contractor shall repair slope erosion and piping holes as required. Sediment shall be removed once it has accumulated to 1/2 design volume. The Contractor shall replace the coarse aggregate filter stone if the sediment pool does not drain within 72 h following a storm water runoff event.

(f) Concrete Washout

The containment system shall be inspected for leaks, spills, and tears, and shall be repaired or replaced as necessary. The Contractor shall ensure that each containment system maintains adequate capacity. Solidified waste concrete shall be disposed of in accordance with 202.

(g) Check Dams

Sediment shall be removed once it reaches 1/2 the height of the check dam. Sediment shall be removed and disposed of in accordance with 201.03 and 203.08. The Contractor shall rebuild or repair each damaged check dam to maintain the design height, cross section, and control function.

205.08 Quality Adjustments

If maintenance deficiencies are not remedied within 48 h after identifying them in the inspection and in accordance with 205.07, the Contractor may be assessed damages for failure to maintain the required storm water management. For each day, during which the following units of storm water management are in an unsatisfactory condition, a quality adjustment, in accordance with 109, will be assessed as shown for each day, per unsatisfactory unit.

(a) Silt Fence: $100.00 per each contiguous 100 ft section or portion thereof
(b) Check Dam: $100.00 per check dam
(c) Sediment Basin: $100.00 per basin
(d) Sediment Trap: $100.00 per trap
(e) Inlet Protection Devices: $100.00 per unit
(f) Failure to inspect site per 327 IAC 15-5 requirements: $100.00 per required inspection
(g) Failure to temporary stabilize non-vegetated areas: $100.00 per acre or portion thereof
(h) Failure to correct identified deficiencies not defined above: $100 per day per measure

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Silt fence will be considered unsatisfactory if the fence material has an exposed cut or tear exceeding 1 ft in length, a seam has separated or the retained sediment exceeds 1/2 of the height of the fence.

Check dams, sediment basins and sediment traps will be considered unsatisfactory if they no longer perform their function, or the retained sediment exceeds 1/2 of the design volume.

Inlet protection devices will be considered unsatisfactory if they no longer perform their function, or the accumulated sediment exceeds 1/2 of the capacity of the device.

205.09 Removal

Storm water management measures shall be removed as soon as an area becomes stable. All storm water management measures shall be removed prior to application for the NOT. The Contractor shall remove and dispose of all excess silt accumulations, dress the area, and reestablish vegetation to all bare areas in accordance with the contract requirements. Use or disposal of storm water management measures shall be as indicated in the SWQCP.

205.10 Method of Measurement

Temporary silt fence and traversable check dams will be measured by the linear foot.

Temporary sediment basins, standard metal end sections and temporary inlet protection will be measured by each unit installed.

Temporary revetment riprap check dams, temporary revetment riprap, temporary sediment traps, splashpads, temporary filter stone, temporary mulch, No. 2 stone for stable construction entrances, and fertilizer will be measured by the ton.

Temporary mulch stabilization, manufactured surface protection products, and temporary geotextile will be measured by the square yard.

Temporary seeding will be measured by the pound.

Removal of sediment will be measured by the cubic yard.

Temporary slope drains will be measured by the linear foot. Measurement will be made for the maximum footage in place at one time, per drain location regardless of the number of times the material is moved.

Temporary filter berms and filter sock will be measured by the linear foot complete in place.

Revetment riprap and filter stone used in sediment basins will be measured by the ton.

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Excavation for detention ponds, temporary sediment traps and temporary sediment basins will be measured as common excavation in accordance with 203.27.

Diversion interceptors type A and B, and interceptor ditches will not be measured for payment. Diversion interceptors type C will be measured by the linear foot.

Mobilization and demobilization for surface stabilization will be measured per each trip as provided in the submitted and accepted SWQCP.

Weekly inspections will be measured by each for inspections conducted after the contract completion date.

SWQCP Preparation and Implementation Level 1 and Level 2 will not be measured.

BMPs used at the off-site locations designated in 205.03 and concrete washouts will not be measured for payment.

205.11 Basis of Payment

The accepted quantities of silt fence and traversable check dams will be paid at the established unit price per linear foot.

Temporary sediment basins, standard metal end sections, and temporary inlet protection will be paid at the established unit price per each unit installed.

Temporary revetment riprap check dams, temporary revetment riprap, temporary sediment traps, splashpads, temporary filter stone, temporary mulch, No. 2 stone for stable construction entrances, and fertilizer will be paid at the established unit price per ton.

Temporary mulch stabilization, manufactured surface protection products, and temporary geotextile will be paid at the established unit price per square yard.

Temporary seeding will be paid at the established unit price per pound.

Removal of sediment will be paid at the established unit price per cubic yard.

Temporary slope drains, temporary filter berms, and filter sock will be paid at the established unit price per linear foot.

Revetment riprap and filter stone used in sediment basins will be paid at the established unit price per ton.

The accepted quantities of excavation for detention ponds, temporary sediment traps, and temporary sediment basins will be paid for as common excavation in accordance with 203.28.

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Diversion interceptors type C will be paid at the established unit price per linear foot.

Payment for mobilization and demobilization for surface stabilization will be paid at the established unit price per each and will be made for the initial movement to the project site, and for each occurrence as indicated in the submitted and accepted SWQCP, or as directed.

Weekly inspections will be paid at the established unit price per each for inspections conducted after the contract completion date. No payment will be made for inspections during the time when liquidated damages in accordance 108.09 are assessed.

The Department will include the pay item Storm Water Management Budget, with an established dollar amount, in the proposal to pay for BMP work. This established amount is the Department's estimate of the total cost of the BMP work required to be performed for the contract. The established amount shown in the proposal is included in the total bid amount. The Department will pay for those items installed and listed with established prices for the quantities installed as indicated in the submitted and accepted SWQCP. If the BMP work exceeds the Department's estimated amount, the additional BMPs shall be explained and submitted as a revision to the SWQCP. The additional work will be reviewed for acceptance in accordance with 104.03 except that the additional BMP work will be paid at the pre-determined established prices shown.

The Department will pay to replace BMPs that have failed during a rain event at the unit price shown in 205.11 if those BMPs had been adequately designed based on the watershed, installed correctly, and maintained as necessary.

The item SWQCP Preparation and Implementation Level 1 will be paid when a Level 1 SWQM is designated in the contract documents. The item SWQCP Preparation and Implementation Level 2 will be paid when a Level 2 SWQM is designated in the contract documents. The item SWQCP Preparation and Implementation Level 1, or Level 2 will be paid as a lump sum. After the SWQCP has been submitted, 25% of the SWQCP Preparation and Implementation bid price will be paid ~~after the SWQCP has been submitted~~. If the SWQCP is submitted in phases, 25% of the SWQCP Preparation and Implementation bid price will be paid after the first phase of the SWQCP has been submitted. The balance will be paid as the plan is implemented over the life of the contract.

Items shown with an established price will be paid at the prices shown. If any of the following items are shown in the schedule of pay items the bid item and price will prevail over the established prices shown.

Payment will be made under:

Pay Item	***Pay Unit***	***Established***

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	Symbol	Price
Diversion Interceptor Type C	*LFT*	*$20.00*
Fertilizer	*TON*	*$725.00*
Filter Sock	*LFT*	*$5.00*
Manufactured Surface Protection Product, _____ ~~*type*~~	*SYS*	*$1.25*
Mobilization and Demobilization for Surface Stabilization	*EACH*	*$650.00*
No. 2 Stone	*TON*	*$25.00*
Sediment, Remove	*CYS*	*$20.00*
Splashpad	*TON*	*$55.00*
Standard Metal End Section	*EACH*	*$340.00*
Storm Water Management Budget	*DOL*	
SWQCP Preparation and Implementation, Level 1	*LS*	
SWQCP Preparation and Implementation, Level 2	*LS*	
Temporary Check Dam, Revetment Riprap	*TON*	*$50.00*
Temporary Check Dam, Traversable	*LFT*	*$15.00*
Temporary Filter Berm	*LFT*	*$15.00*
Temporary Filter Stone	*TON*	*$40.00*
Temporary Geotextile	*SYS*	*$2.50*
Temporary Inlet Protection	*EACH*	*$100.00*
Temporary Mulch Stabilization, _____ ~~*type*~~	*SYS*	*$0.25*
Temporary Mulch	*TON*	*$400.00*
Temporary Revetment Riprap	*TON*	*$50.00*
Temporary Sediment Basin	*EACH*	*$3,000.00*
Temporary Sediment Trap	*TON*	*$40.00*
Temporary Seed	*LBS*	*$2.50*
Temporary Silt Fence	*LFT*	*$2.00*
Temporary Slope Drain	*LFT*	*$20.00*
Weekly Inspection	*EACH*	*$400.00*

The cost associated with revisions to permits shall be included in the cost of SWQCP Preparation and Implementation.

The cost for trenching, backfilling, posts, fencing, and all necessary incidentals shall be included in the cost of the pay item for temporary silt fence.

The cost for stakes, trenching, backfilling, posts, and all necessary incidentals shall be included in the cost of the pay item for temporary check dams, traversable.

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The payment for temporary sediment basin shall include all costs involved with construction of the basin except for excavation, revetment riprap, and filter stone.

The payment for temporary sediment trap shall include all costs involved with construction of the trap except for excavation.

Temporary entrances utilized by the Contractor for borrow and waste areas will not be paid for directly.

The costs for diversion interceptor types A and B and interceptor ditches shall be included in the cost of the earth moving items.

The cost for anchors and all incidentals necessary to perform the work shall be included in the cost of the pay item for temporary slope drains.

The cost of materials, installation, inspection, maintenance, and removal of storm water management measures at off-site locations designated in 205.03 will not be measured for payment.

The payment for BMPs in this section shall include materials, installation, maintenance, removal and proper disposal, except for the removal of sediment.

The cost associated with sediment removal and temporary filter stone replacement due to BMP maintenance shall be included in the cost of the pay item for sediment removal.

The cost of constructing, maintaining, and removal of the construction entrance, other than those constructed by the Contractor for borrow and waste sites, shall be included in the cost of No. 2 stone. No direct payment will be made for construction entrances for borrow and waste sites.

The cost associated with concrete washout shall not be paid for directly, but shall be included in the costs of the concrete pay items.

The costs associated with the weekly and post-event inspections and all other inspections conducted prior to the contract completion date shall be included in the costs of the other pay items of this section.

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205-R-261 QUALITY CONTROL TEMPORARY EROSION AND SEDIMENT CONTROL

(Revised 08-20-15)

The Standard Specifications are revised as follows:

SECTION 108, DELETE LINES 114 THROUGH 219.

SECTION 205, DELETE LINES 1 THROUGH 516.

SECTION 205, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 205 - QUALITY CONTROL TEMPORARY EROSION AND SEDIMENT CONTROL

205.01 Description

This work shall consist of furnishing, installing, maintaining, and removing temporary erosion and sediment control measures in accordance with the approved contractor developed Erosion and Sediment Control Quality Control Plan.

MATERIALS

205.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class F or Higher 904
Fertilizer.....914.03
Filter Sock.....914.09(h)
Geotextile 918
Grass Seed, Temporary.....914.02
Manufactured Surface Protection Products.....205.04(c)
Metal End Sections.....908.06
Mulch.....914.05(a)
Pipe Drains .....715.02(d)
Plastic Net .....914.09(g)
*Revetment Riprap 904**
Stakes.....914.09(b)
Top Soil 914.01
Water .....914.09(a)
Staples .....914.09(f)

**The minimum depth does not apply. Straw bales shall not weigh less than 35 lb. Bales shall be bound with wire or nylon twine.*

CONSTRUCTION REQUIREMENTS

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205.03 General Requirements

The Contractor shall locate, install, maintain and remove temporary sediment and erosion control Best Management Practices, BMPs, for earth disturbing activity areas, and develop a project specific Revised SWPPP in accordance with IAC 327 15-5. The SWPPP shall be developed as part of the E&SC Quality Control Plan, QCP. The SWPPP shall be developed by a professional engineer who also holds a current Certified Professional in Erosion and Sediment Control, CPESC, certification or approved equivalent. The SWPPP developer shall be familiar with the project site and develop the SWPPP in accordance with the site conditions. The SWPPP shall be revised as required. The Contractor shall furnish and install temporary sediment and erosion control best management practices in compliance with all National Pollutant Discharge Elimination System, NPDES, and surface water permits. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, State or local agencies the Contractor shall adhere to the more restrictive laws, rules, or regulations.

If a governmental agency or a local governmental authority finds a violation of NPDES or any surface water permits that were provided in the bid documents or that the BMPs are incomplete, or that the SWPPP is incomplete or that the implementation of the SWPPP is not performed or complete, full responsibility shall be borne by the Contractor to make corrections. In addition if an assessment, damage judgment or finding, agreed order, fine or any other expense for a violation of the contract requirements is leveled against the Department, the Contractor shall reimburse the State for that amount within 30 days. The Contractor agrees to indemnify and hold harmless the Department and will reimburse the Department for any assessments, damage judgments or finding, fine, penalty or other expense relating to this portion of the contract. The Department may withhold the amount owed from the Contractor's subsequent pay estimates. Delays caused by stop work orders from regulatory agencies, suspension of work orders from the Department, or any other delays caused by inadequate submittals or implementation will be considered Non-Excusable Delays in accordance with 108.08(c).

(a) Storm Water Quality Manager

The Contractor shall designate one person as Storm Water Quality Manager, SWQM. The SWQM shall be responsible for ensuring the preparation, submittal, and receipt of the approved QCP. The SWQM shall be responsible for the installation, maintenance, and removal of all erosion and sediment control measures and shall be in responsible charge of the weekly and post-event inspections. The inspections shall be documented in the erosion and sediment control inspection report form provided by the Engineer and available on the Department's website. The SWQM shall attend the preconstruction conference and at least one scheduling meeting per calendar month when earth disturbing activities are a significant work activity. The SQWM shall accompany personnel from IDEM or other governmental agencies, as required, during site visits by those agencies. The SWQM shall be responsible for completion of all inspection reports. The name of the SWQM shall be furnished to the Engineer at, or prior to, the

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preconstruction meeting. If the designated individual needs to be replaced during the contract time, the replacement shall be designated within 24 h and notification shall be furnished to the Engineer.

For contracts that have had a Notice of Intent, NOI, filed per 327 IAC-15-5 or require a 401/404 or any other waterway permit, the SWQM shall have attended the Department's Construction Storm Water Certification course, or be certified as a Certified Erosion Sediment and Stormwater Inspector, CESSWI, or CPESC by Envirocert, Inc. or an approved equal.

(b) Design

The Contractor shall prepare and implement the project QCP for all temporary erosion and sediment control measures in accordance with 327 IAC 15-5, Chapter 205 of the Indiana Department of Transportation Design Manual, the IDEM "Indiana Storm Water Quality Manual", and all other applicable contract documents. The Contractor shall incorporate into his SWPPP all included plan sheets for temporary erosion and sediment control. The QCP shall include the Contractor's Revised SWPPP and plan to comply with all known permit requirements applicable to the construction phase of the project included in the NOS, 401/404 and all other permits as well as those required by the Contractor in accordance with 107.01. The Contractor's SWPPP shall be stamped by the SWPPP developer as defined above. The SWPPP developer shall issue clarifications, and correct errors and omissions as required. The SWPPP shall address the construction phasing and include the proper sequencing of installation of temporary erosion and sediment control measures for the protection of Waters of the United States and off-site sedimentation. The plan shall address the installation, maintenance, and removal sequencing of temporary erosion and sediment control measures during construction of the proposed project and shall also include haul roads, stockpile sites, equipment storage sites, plant sites, and borrow and disposal sites as applicable. A copy of the Notice of Sufficiency, NOS, that includes operations at offsite stockpile, borrow, waste, or storage areas shall be submitted to the Engineer prior to operations at those sites. Electronic files of any plan sheets and narratives shall be provided in .pdf format.

The Contractor may elect to prepare and submit the SWPPP in multiple phases, the first phase showing location, installation, and maintenance of temporary sediment and erosion control BMPs for the existing topography of the project during clearing activities prior to earth moving activities for the remaining construction. Additional phases shall show the progression from the existing topography to the final grade. The first phase of the SWPPP may be submitted prior to the subsequent phases, however no earth moving work or any other work not shown and approved in the first phase shall begin until approval of the additional phases of the SWPPP. Each phase of the SWPPP shall be modified to meet existing field conditions as needed.

(c) QCP Preparation and Implementation

The QCP shall be prepared by or under the supervision of the SWQM and in accordance with ITM 803, Contractor Quality Control Plans. The QCP shall include a discussion of how the

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Contractor intends to comply with the requirements as outlined in this section.

The QCP shall be submitted to the Engineer for review. If the Contractor elects to submit the first phase of the SWPPP prior to the complete QCP, it shall be submitted 15 days prior to the beginning of clearing activities. The complete QCP including at least the SWPPP for the next phase of work shall be submitted to the Engineer at least 15 days prior to commencing earth moving activities. No earth moving activity shall begin until after the QCP has been received and approved by the Department. The cost of the QCP shall be included in the cost of E&SC QCP Preparation and Implementation.

The item E&SC Budget is included in the schedule of pay items to establish a budget to fund payment of the items listed in 205.11 with an established price. The Contractor shall provide a cost summary using the prices shown in 205.11 in spreadsheet format as the cost proposal for implementing the QCP.

At a minimum the SWPPP shall include the following:

1. *Locations of all proposed top soil stockpiles.*

2. *Locations of all proposed equipment storage areas, fueling locations, construction trailers, batch plants, and designated concrete truck washout areas.*

3. *Proposed construction sequence and phasing of erosion control measures.*

4. *Locations and design flow from offsite areas that drain onto project limits. The QCP design shall include BMPs properly sized and placed to accommodate runoff from outside of the project limits and the drainage quantity from within the project limits.*

5. *Location of all construction entrances where vehicles and equipment will enter and exit the site.*

6. *Material handling and spill prevention plan.*

7. *Statements that the erosion control measures for the project shall, at a minimum, be inspected on a weekly basis and within 24 h of every 1/2 in. rain event.*

8. *Provisions to ensure that pollutants such as fuels, lubricants, asphalt, sewage, wash water, or waste from concrete mixing operations, and other harmful materials shall not be discharged into existing bodies of water.*

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9. *Provisions to ensure that all applicable regulations and statutes relating to the prevention and abatement of pollution shall be complied with in the performance of the contract.*

10. *Statement that all appropriate erosion control items shall be in place prior to disturbing the project site.*

When Waters of the United States are located within the project limits the following shall also be addressed in the SWPPP:

1. *A method for delineating the boundaries of the waters of the US as shown on the plans.*

2. *When work areas are located in or adjacent to bodies of water, all work in those locations shall be conducted in strict compliance with all conditions as outlined in the 401/404 permits.*

The installation of temporary erosion and sediment control measures shall include those necessary or required by permits at off-site locations such as borrow and disposal areas, field office sites, batch plants, locations where the Contractor's vehicles enter and leave public roads, and other locations where work pertaining to the contract is occurring. The Contractor's SWQM shall be responsible for the installation, inspection, and maintenance of these measures. Temporary erosion control measures shall be placed as soon as practicable. Perimeter protection and sediment traps shall be installed prior to beginning earth disturbing activities. Pipe end sections and anchors shall be installed when the structure is installed. If the pipe end sections or anchors cannot be placed at the same time, temporary riprap splashpads shall be placed at the outlets of the pipes until end sections or anchors can be installed.

Adjustments of the erosion and sediment control measures shall be made to satisfy field conditions and shall be subject to the Engineer's approval. Adjustments made to meet field conditions shall be made as soon as practicable and shall be maintained as necessary.

The Contractor shall provide a stable construction entrance at the points where construction traffic will enter onto an existing road. Additional stone may be required, as directed by the Engineer. Where there is insufficient space for a stable construction entrance, other measures shall be taken to prevent the tracking of sediment onto the pavement. These temporary entrances shall be the responsibility of the Contractor to completely install, maintain, and remove.

The Contractor shall provide concrete washout facilities of adequate capacity in accordance with project requirements. The concrete washout shall be located as far from surface

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waters as practical, and shall be able to contain all liquid and solid material from concrete truck or mixer washing operations without contacting or contaminating the ground.

The Contractor shall employ dust control measures in accordance with 107.08(b).

(d) Permanent Erosion Control Features

Permanent erosion control measures shall be incorporated into the work at the earliest practicable time.

205.04 Temporary Surface Stabilization

Non-vegetated areas shall be temporary stabilized if the area remains inactive for more than seven days or as directed by the Engineer. The area will be considered inactive when no meaningful work toward accomplishing a pay item has been performed at a site of disturbed soil.

(a) Seed

Temporary seeding shall be placed on disturbed areas that are expected to be inactive for more than seven days, or as directed. Seed shall be placed either by drilling in, spraying in a water mixture, or by use of a mechanical method which places the seed in direct contact with the soil. Where inaccessible to mechanical equipment, or where the area to be seeded is small, a hand operated cyclone seeder or other approved equipment may be used. Seed shall not be covered more than 1/2 in. Seed may be distributed by a drill seeder, cyclone seeder, hand or other approved equipment which allows for even distribution of the seed. If as a result of a rain event, the prepared seed bed becomes crusted or eroded, or ruts, or depressions exist, the soil shall be reworked until it is smooth. Reworked areas shall be re-seeded. All seeded areas shall be mulched within 24 h after seeding.

Seed mixture T shall be used for surface stabilization and temporary ground cover. Temporary cover mixtures shall be placed as directed and be subject to seasonal limitations as defined herein. This mixture is not intended to be used as a permanent seed mixture. This mixture shall not be used to satisfy the requirements of the warranty bond.

The mix shall be spray mulched where the slope is steeper than 3:1. From June 16 through August 31, mulching alone shall be used to stabilize the soil.

1. Spring Mix

Spring mix shall be used from January 1 through June 15. This mixture shall be applied at the rate of 150 lb/ac. The mix shall consist of oats.

2. Fall Mix

Fall mix shall be used from September 1 through December 31. This mixture shall be applied at the rate of 150 lb/ac. This mix shall consist of winter wheat.

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Where directed, fertilizer shall be spread uniformly over the area to be seeded and shall be applied at 1/2 the rate shown in 621.05(a) unless otherwise directed. Fertilizer shall only be applied during the active growing season March through November.

(b) Mulch

Mulch shall be applied uniformly in a continuous blanket at the rate of 2.5 t/ac. If seeded, mulch shall be placed within 24 h after seeding. The percent of moisture in the mulch shall be determined in accordance with 621.14(c).

Mulch shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally to the slope. The tools used for punching purposes shall be disks that are notched and have a minimum diameter of 16 in. The disks shall be flat or uncupped. Disks shall be placed a minimum of 8 in. apart. Shaft or axle sections of disks shall not exceed 8 ft in length.

The disk for punching shall be constructed so that weight may be added or hydraulic force may be used to push puncher into the ground. An even distribution of mulch shall be incorporated into the soil.

On a slope of 3:1 or steeper but flatter than 2:1, or where specified, temporary mulch stabilization shall also be used. Unless otherwise specified, the following types may be used.

1. Type A

The mulch shall be held in place by means of commercially produced water borne mulch binder product. The product shall be manufactured and used in accordance with all applicable State and Federal regulations. Such product shall be applied in accordance with the manufacturer's written instructions. A copy of the written instructions shall be supplied to the Engineer prior to the seeding work. The product shall include a coverage indicator to facilitate visual inspection for evenness of application. If the mulch fails to stay in place, the Contractor shall repair all damaged areas.

2. Type B

The mulch shall be held in place with binder twine fastened down with wooden pegs not less than 6 in. long spaced 4 ft apart. The twine shall be placed parallel to and also at 60° to the pavement edge in both directions. The distance between the intersections of the diagonal strands measured along the strands shall be 12 ft. The strand parallel to the pavement shall cross the diagonal strands at their intersections to form equilateral triangles of 12 ft on a side.

3. Type C

The mulch shall be held in place with a polymeric plastic net. The plastic net shall be unrolled such that it lays out flat, evenly, and smoothly, without stretching the material. The plastic net shall be held in place by means of staples. The staples shall be driven at a 90° angle

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to the plane of the soil slope. Staples shall be spaced not more than 4 ft apart with rows alternately spaced. The plastic net shall be secured along the top and bottom of the soil slope with staples spaced not more than 1 ft on center. The ends and edges of the plastic net shall be overlapped approximately 4 in. and stapled. Overlaps running parallel to the slope shall be stapled 1 ft on center and overlaps running perpendicular to the slope shall be stapled at least 3 ft on center. The plastic net shall be placed with the length running from top of slope to toe of slope, or the plastic net shall be placed with the length running horizontally or parallel to the contour.

On a slope of 2:1 or steeper, or where specified, a manufactured surface protection product shall be used.

(c) Manufactured Surface Protection Products

The following manufactured surface protection products may be used for covering an area that has not been seeded. Soil cover shall not be used to cover seeded areas. Prior to placing the manufactured surface protection product, the area to be covered shall be free of all rocks or clods of over 1 1/2 in. in diameter, and all sticks or other foreign material, which prevent the close contact of the blanket with the seed bed.

After the area has been properly shaped, fertilized, and seeded, the manufactured surface protection product shall be laid out flat, evenly, and smoothly, without stretching the material.

1. Excelsior Blanket

An excelsior blanket may be used as mulch for seeding where seeding is specified or where erosion control blanket is specified. Excelsior blankets shall be placed within 24 h after seeding operations have been completed. Excelsior blankets shall be installed in accordance with the manufacturer's recommendation.

2. Straw Blanket

A straw blanket may be used as mulch for seeding where mulched seeding is specified or where erosion control blanket is specified. Straw blankets shall be placed within 24 h after seeding. The straw blanket shall be unrolled over the designated area so that the plastic mesh is on top and the straw fibers are snugly and uniformly in contact with the soil surface. The rolls shall be butted together and stapled in place. The staples shall be driven through the blanket at a 90° angle to the plane of the ground surface. Each staple shall anchor the plastic mesh. The staples shall be spaced per the manufacturer's recommendation.

For placement on a slope, the straw blankets shall be placed with the length running from the top of slope to the toe of slope and shall extend a minimum of 3 ft over the crown of the slope. The blanket shall be stapled in accordance with the manufacturer's recommendation.

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For placement in ditch lines, the straw blanket shall be unrolled parallel to the centerline of the ditch. The blanket shall be placed so that there are no longitudinal seams within 24 in. of the bottom centerline of the ditch. In a ditch line, the blanket shall be stapled in accordance with the manufacturer's recommendation with a minimum of six staples across the upstream end of each roll.

3. Rolled Erosion Control Products

Where directed, the Contractor shall install, or with approval of the Engineer, the Contractor may use degradable rolled erosion control products, RECP, including netting, open weave textile, and erosion control blankets.

Unless soil infilling is required, seed shall first be applied in accordance with 621. If soil infilling is required, RECP shall be first installed and then seed applied and brushed or raked 1/4 to 3/4 in. of topsoil into voids in the RECP filling the full product thickness. Staples of at least 6 in. in length shall be used to secure the RECP. The RECP shall be unrolled parallel to the primary direction of flow and placed in direct contact with the soil surface. RECP shall not bridge over surface inconsistencies. Edges of adjacent RECP shall be overlapped by 2 to 4 in. Staples shall be placed to prevent seam separation in accordance with the manufacturer's recommendations.

4. Geotextile

Where directed or as shown on the SWPPP, disturbed soil shall be covered with geotextile. The covering shall be placed over the exposed soil in a shingle like fashion with a 2 ft minimum overlap covering all loose or disturbed soil. The geotextile, if new, shall be in accordance with 918.02. The geotextile used for soil covering need not be new but shall not have holes or unrepaired rips or tears. All repairs shall be made in accordance with the manufacturer's recommendation.

205.05 Concentrated Flow Protection

(a) Check Dam

Check dams and modified check dams shall be constructed as shown on the plans. Geotextile for check dams shall be in accordance with 616 unless otherwise specified. Temporary revetment riprap shall be in accordance with 616. No. 5 and No. 8 filter stone shall be in accordance with 904.

(b) Check Dam, Traversable

Traversable check dams shall be composed of straw bales, 8 in. minimum diameter fiber rolls, or 8 in. minimum diameter socks filled with straw, ground wood chips, shredded bark, or other approved material for site specific conditions. Rolls and socks may be stacked in a triangle pattern as shown on the plans. Check dams shall be staked as shown on the plans or as directed

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by the manufacturer. Check dams shall be configured to eliminate gaps between sections. Straw bales shall be placed such that the bindings are parallel to and not in contact with the ground.

(c) Diversion Interceptors

Grading for diversion interceptors shall be in accordance with 203 with the exception that compaction requirements will not apply. The Contractor shall identify, in the SWPPP, the construction areas which shall utilize diversion type A or B. Slope drains shall be provided at the low points of the diversion interceptor. If required in the SWPPP, perimeter diversion, type C shall be installed prior to earth moving activities and shall be immediately stabilized. Type A or B shall be stabilized if anticipated to be left in place for more than seven calendar days. Stabilization methods shall be as shown in the SWPPP or as directed by the Engineer.

(d) Sediment Traps

Sediment Traps shall be constructed with revetment riprap, filter stone and geotextile.

(e) Sediment Basins

Embankment construction shall be in accordance with 203. Temporary Revetment riprap used for overflow protection shall be in accordance with 904, unless otherwise specified. Sediment basins shall be constructed as shown on the plans, or as directed. Sediment basins shall be designed to provide a minimum storage volume to contain the runoff from a 10 year 24 h storm event.

(f) Slope Drains

Slope drain pipes shall be lengthened as required due to the construction of the embankment.

(g) Vegetative Filter Strips

Designated vegetative filter strips shall not be disturbed. Small rills that form shall be repaired. Fertilizer shall be applied as directed.

(h) Splashpads

Splashpads shall be constructed with revetment riprap with geotextile.

(i) Inlet Protection

All deck and curb drains shall have sediment control measures when the structure or road is to be used for hauling operations or adjacent to disturbed areas. Copies of all current manufacturers' installation manuals shall be provided prior to installation.

205.06 Perimeter Protection

(a) Silt Fence

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Shipping, handling and storage shall be in accordance with the manufacturer's recommendations. The silt fence material shall be in accordance with 918.04. The silt fence material will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, storage, or installation. Each roll shall be labeled or tagged to provide product identification.

Joints shall be made from the ends of each section of fence wrapped around a wood stake and joined together or other method recommended by the manufacturer. Copies of all current manufacturer manuals shall be provided prior to installation.

(b) Filter Berm

A filter berm shall be installed as shown on the plans or in the SWPPP. The filter berm may be constructed of organic mulch, filter sock, or No. 5 and No. 8 filter stone.

205.07 Maintenance

Temporary erosion and sediment control measures shall be inspected, at a minimum, once every seven days and after a 1/2 in. rain event. Inspections shall be documented and records shall be maintained by the Contractor, to be submitted to the Engineer on the next business day following the inspection. The temporary protection measures shall be returned to working conditions within 48 h after inspection or as directed. The Contractor shall rebuild or repair damaged temporary erosion and sediment control measures.

(a) Silt Fence

If the fence fabric tears, starts to decompose, or becomes ineffective, the affected portion shall be replaced. Deposited sediment shall be removed once it reaches 1/2 the height of the fence at its lowest point. Once the contributing drainage area has been stabilized, the Contractor shall remove the fence and sediment deposits, grade the site to blend with the surrounding area, and stabilize the graded area.

(b) Sediment Basin

Sediment shall be removed once it has accumulated to 1/2 the design volume. The filter stone around the riser pipe shall be replaced if the sediment pool does not drain within 72 h following a stormwater runoff event.

(c) Filter Berm

Accumulated sediment shall be removed once it reaches 1/4 of the height of the filter berm. The filter berm shall be inspected to ensure that it is holding its shape and allowing adequate flow. Eroded and damaged areas shall be repaired.

(d) Inlet Protection

Accumulated sediment shall be removed once identified and after each storm event. Flushing with water will not be allowed. The sediment shall not be allowed to re-enter the paved

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area or storm drains. Curb inlet inserts shall be cleaned in accordance with the manufacturer's recommendations.

(e) Sediment Traps

Following each storm event, the Contractor shall repair slope erosion and piping holes as required. Sediment shall be removed once it has accumulated to 1/2 design volume. The Contractor shall replace the coarse aggregate filter stone if the sediment pool does not drain within 72 h following a stormwater runoff event.

(f) Concrete Washout

The containment system shall be inspected for leaks, spills, and tears, and shall be repaired or replaced as necessary. The Contractor shall ensure that each containment system maintains adequate capacity. Solidified waste concrete shall be disposed of in accordance with 202.

(g) Check Dams

Sediment shall be removed once it reaches 1/2 the height of the check dam. Sediment shall be removed and disposed of in accordance with 201.03 and 203.08. The Contractor shall rebuild or repair each damaged check dam to maintain the design height, cross section, and erosion control function.

205.08 Quality Adjustments

If maintenance deficiencies are not remedied within 48 h after identifying them in the inspection or as directed, the Contractor may be assessed damages for failure to maintain the required temporary erosion and sediment control. For each day, during which the following units of temporary erosion and sediment control are in an unsatisfactory condition, a quality adjustment, in accordance with 109, will be assessed as shown for each day, per unsatisfactory unit.

If conditions do not allow the Contractor access to the location of the erosion or sediment control features using normal equipment and maintenance has been directed, the Contractor may propose a written alternate schedule, within 48 h, to bring the erosion and sediment control features back into compliance. Damages may be assessed based on compliance with the approved schedule.

(a) Silt Fence: $100.00 per each contiguous 100 ft section or portion thereof
(b) Check Dam: $100.00 per check dam
(c) Sediment Basin: $100.00 per basin
(d) Sediment Trap: $100.00 per trap
(e) Inlet Protection Devices: $100.00 per unit
(f) Failure to inspect site per 327 IAC requirements: $100.00 per required inspection

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(g) Failure to temporary stabilize non-vegetated areas: $100.00 per acre or portion thereof
(h) Failure to correct identified deficiencies not defined above: $100 per day per measure

Silt fence will be considered unsatisfactory if the fence material has an exposed cut or tear exceeding 1 ft in length, a seam has separated or the retained sediment exceeds 1/2 of the height of the fence.

Check dams, sediment basins and sediment traps will be considered unsatisfactory if they no longer perform their function, or the retained sediment exceeds 1/2 of the design volume.

Inlet protection devices will be considered unsatisfactory if they no longer perform their function, or the accumulated sediment exceeds 1/2 of the capacity of the device.

205.09 Removal

Temporary erosion and sediment control measures shall remain in place until directed to be removed. The Contractor shall remove and dispose of all excess silt accumulations, dress the area, and vegetate all bare areas in accordance with the contract requirements. Use or disposal of temporary erosion and sediment control measures shall be as directed.

205.10 Method of Measurement

Temporary Silt fence and check dams, traversable will be measured by the linear foot. Temporary Sediment basins will be measured by each. Temporary Revetment riprap check dams, temporary sediment traps, and splashpads will be measured by the ton. Temporary filter stone will be measured by the ton. Temporary mulch will be measured by the ton. Temporary mulch stabilization will be measured by the square yard. Temporary seeding will be measured by the pound. Temporary geotextile used as a manufactured surface protection product will be measured by the square yard, and only once for the maximum square yardage in place at one time, regardless of the number of times the material is moved. Removal of sediment will be measured by the cubic yard. Temporary revetment riprap will be measured by the ton. Temporary slope drains will be measured by the linear foot, and only once for the maximum footage in place at one time, per drain location regardless of the number of times the material is moved. Temporary Inlet protection will be measured per each unit installed. Temporary Filter berms will be measured by the linear foot complete in place. Filter sock will be measured by the linear foot, complete in place. Concrete washouts will not be measured separately. No. 2 stone for stable construction entrances will be measured by the ton. Revetment riprap and filter stone used in sediment basins will be measured by the ton. Fertilizer will be measured by the ton. Manufactured surface protection product, type will be measured by the square yard. Mobilization and demobilization for surface stabilization will be measured per each trip as provided in the SWPPP, or as directed, to the project site. Standard metal end sections will be measured by each.

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Diversion interceptors type A and B, and interceptor ditches will not be measured for payment. Diversion interceptors type C will be measured by the linear foot.

BMPs used at the off-site locations designated in 205.03 will not be measured for payment.

Excavation for detention ponds, temporary sediment traps and temporary sediment basins will be measured as common excavation in accordance with 203.27.

Weekly inspections will be measured by each for inspections conducted after the contract completion date. E&SC QCP Preparation and Implementation will not be measured.

205.11 Basis of Payment

The accepted quantities of silt fence will be paid for at the established unit price per linear foot, complete in place. Temporary mulch will be paid at the established unit price by the ton. Temporary mulch stabilization will be paid for at the established unit price by the square yard. Temporary seeding will be paid for at the established unit price per pound. Temporary geotextile will be paid at the established unit price by the square yard. Temporary check dams, revetment riprap, temporary sediment trap and splashpads will be paid for at the established unit price by the ton. Temporary filter stone will be paid for at the established unit price by the ton. Temporary check dams, traversable will be paid for at the established unit price by the linear foot. Temporary revetment riprap will be paid for at the established unit price by the ton. Temporary filter berms will be paid at the established unit price by the linear foot. Temporary entrances utilized by the Contractor for borrow and waste areas will not be paid for directly. Temporary slope drains will be paid for at the established unit price by the linear foot. Removal of sediment will be paid for at the established unit price per cubic yard. Temporary inlet protection will be paid for at the established unit price per each unit installed. Filter sock will be paid for at the established unit price by the linear foot. Diversion Interceptors, type C will be paid by the linear foot at the established unit price. No. 2 stone for stable construction entrances will be paid for at the established unit price by the ton. Revetment riprap and filter stone used in sediment basins will be paid for at the established unit price by the ton. Fertilizer will be paid for at the established unit price by the ton. Manufactured surface protection product type, will be paid for at the established unit price by the square yard. Payment for mobilization and demobilization for surface stabilization will be paid at the established unit price per each and will be made for the initial movement to the project site for each occurrence as provided in the SWPPP, or as directed, so that temporary seeding, mulching or other surface stabilization is performed. Payment for standard metal end sections will be at the established unit price per each.

The accepted quantities of excavation for detention ponds, temporary sediment traps and temporary sediment basins will be paid for as common excavation in accordance with 203.28

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Weekly Inspections will be paid at the established unit price by each for inspections conducted after the contract completion date. No payment will be made for inspections during the time when Liquidated Damages in accordance 108.09 are assessed.

The Department will pay for those items listed in 205.11 with Established Prices in the quantities installed and as shown in the department approved QCP at the established price. The Department will include the pay item E&SC Budget, with an amount, in the proposal to pay for BMP work. The fixed amount shown in the proposal is included in the Total Bid Amount. This fixed amount is the Department's estimate of the total cost of the BMP work required to be performed for the contract. If the BMP work exceeds this amount, the BMP work will be paid at the pre-determined prices. Other BMPs required to implement the QCP will be considered in accordance with 104.03.

The item E&SC QCP Preparation and Implementation will be paid as a Lump Sum. The item will be considered 60% complete when approved by the Engineer. 60% of the bid price will be paid when the QCP is approved. The balance will be paid as the plan is implemented. 5% of the bid price will be paid in each subsequent progress payment until 100% of the bid price has been reached.

BMPs required for permit compliance will be considered in accordance with 104.03.

The Department will pay to replace BMPs that have failed during a rain event at the unit price shown in 205.11 if those BMPs had been adequately designed based on the watershed, installed correctly, and maintained when needed.

Items shown with an Established Price will be paid at the price shown. If any of the following items are shown in the schedule of pay items the bid item and price will prevail over the established price.

Payment will be made under:

Pay Item	***Pay Unit Symbol***	***Established Price***
Diversion Interceptor Type C	*LFT*	*$20.00*
E&SC Budget	*DOL*	
E&SC QCP Preparation and Implementation	*LS*	
Fertilizer	*TON*	*$725.00*
Filter Sock	*LFT*	*$5.00*
Manufactured Surface Protection Product, _____ type	*SYS*	*$1.25*
Mobilization and Demobilization for Surface Stabilization	*EACH*	*$650.00*

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No. 2 Stone	*TON*	*$25.00*
Sediment, Remove	*CYS*	*$20.00*
Splashpad	*TON*	*$55.00*
Standard Metal End Section	*EACH*	*$340.00*
Temporary Check Dam, Revetment Riprap	*TON*	*$50.00*
Temporary Check Dam, Traversable	*LFT*	*$15.00*
Temporary Filter Berm	*LFT*	*$15.00*
Temporary Filter Stone	*TON*	*$40.00*
Temporary Geotextile	*SYS*	*$2.50*
Temporary Inlet Protection	*EACH*	*$100.00*
Temporary Mulch	*TON*	*$400.00*
Temporary Mulch Stabilization,_____ type	*SYS*	*$0.25*
Temporary Revetment Riprap	*TON*	*$50.00*
Temporary Sediment Basin	*EACH*	*$3,000.00*
Temporary Sediment Trap	*TON*	*$40.00*
Temporary Seed	*LBS*	*$2.50*
Temporary Silt Fence	*LFT*	*$2.00*
Temporary Slope Drain	*LFT*	*$20.00*
Temporary Underdrain Outlet Pipe	*LFT*	*$5.00*
Weekly Inspection	*EACH*	*$400.00*

The payment for temporary silt fence includes trenching, backfilling, posts, fencing, and all necessary incidentals.

The costs for diversion interceptor types A and B and interceptor ditches shall be included in the cost of the earth moving items.

The payment for temporary check dams, traversable includes stakes, trenching, backfilling, posts, and all necessary incidentals.

The payment for temporary sediment basin includes all costs involved with construction of the basin except for the excavation, which will be paid as common excavation in accordance with 203.28, and the use of revetment riprap and filter stone, which are separate pay items.

The payment for temporary sediment trap is to include all costs involved with construction of the trap except for the excavation, which will be paid as common excavation in accordance with 203.28.

The payment for temporary slope drain include anchors and all incidentals necessary to perform the work.

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The cost of materials, installation, inspection, maintenance, and removal of temporary erosion and sediment control measures at off-site locations designated in 205.03 will not be measured for payment.

Except for the removal of sediments, the payment for items in this section includes materials, installation, maintenance, removal and proper disposal of temporary erosion and sediment control items.

The cost of constructing, maintaining, and removal of the construction entrance, other than those constructed by the Contractor for borrow and waste sites, shall be included in the cost of No. 2 stone. No direct payment will be made for construction entrances for borrow and waste sites.

Costs associated with concrete washout shall be included in the costs of the concrete pay items.

Payment for sediment removal includes costs associated with temporary filter stone replacement due to maintenance and sediment removal.

Costs associated with the weekly and post-event inspections and all other inspections conducted prior to the contract completion date are to be included in the costs of the other pay items of this section.

FINAL DRAFT MINUTES

ATTACHMENT 9-3

PIPE RATINGS

Pipe Ratings

LARGE CULVERT NO.	LOCATION	OVERALL RATING	VERTICAL OPENING (FT)	SPAN (FT)	MATERIAL	SHAPE	LINED
65-37-228.55	1.01 miles south of SR 10	5	5	5	Corrugated Metal	Circular	No
65-37-229.15	0.41 miles south SR 10	5	4.5	6.5	Corrugated Metal	Circular	No
65-37-230.60N	0.93 miles North of SR 10	8	7	7	Corrugated Metal	Circular	Yes
65-37-230.60S	0.93 miles North of SR 10	8	7	7	Corrugated Metal	Circular	Yes
65-45-241.20	1.2 Miles North of SR 2 ----- North End of Ramps at scales	3	3	5	Corrugated Metal	Arch	No
65-45-241.70	1.60 miles North on SR 2	6	5	6.5	Plated Metal	Arch	No
65-45-244.10	3.36 miles South US 231	7	3.58	4.58	Plated Metal	Arch	No
65-45-244.20	3.28 miles South of US 231	8	3	4	Corrugated Metal	Arch	Yes

LARGE CULVERT NO.	LOCATION	OVERALL RATING	VERTICAL OPENING (FT)	SPAN (FT)	MATERIAL	SHAPE	LINED
65-45-244.60	2.73 miles South of US 231	5	5.5	8	Plated Metal	Arch	No
65-45-245.75	1.30 miles South of US 231	8	3.58	4.58	Corrugated Metal	Elliptical	Yes
65-45-246.10	0.83 miles South of US 231	8	1.58	3	Corrugated Metal	Elliptical	Yes
65-45-248.79	0.05 miles South of 113th	7	5	6	Corrugated Metal	Elliptical	No
65-45-248.90	just north of 113th bridge (at north side of bridge)	7	3	4.33	Corrugated Metal	Elliptical	No
65-45-249.20	1.87 miles North of US 231	6	12	12	Reinforced Concrete Box	Square	No
65-45-252-04	0.78 miles South of US 30	7	4	4	Corrugated Metal	Circular	No
65-45-252.95	.28 MILES NE OF US 30 ON NB RAMP TO 65-at very end-	7	7	11	Corrugated Metal	Elliptical	No
65-56-232.20	2.64 miles North of SR 10	5	7	7	Corrugated Metal	Circular	No
65-56-233.15	3.59 miles North of SR 10	5	5	7	Plated Metal	Arch	No
65-56-234.35	4.79 miles North of SR 10	7	12	19	Plated Metal	Arch	No
65-56-234.40	4.84 miles North of SR 10	5	10	15	Plated Metal	Arch	No

Note: Slopes were determined using a Johnson Glo-View level and should be field verified.

ATTACHMENT 10-1

UNIQUE SPECIAL PROVISIONS

Traffic

A. Indiana Logo Signs

INDIANA LOGO SIGNS

Description

This work shall consist of coordinating with the Indiana Logo Sign Group and relocating existing Indiana Logo Sign Group panel signs on an as-needed basis. The Indiana Logo Sign Group panel signs are the blue specific information panel signs that have a separately attached sign consisting of a single or multicolored symbolic design unique to a product, business, or service facility located on wide flange structures within the I-65 right-of-way. They are used to identify traveler services that are available on a crossroad at or near an interchange or an intersection. The Design-Build Contractor shall coordinate with the Indiana Logo Sign Group regarding the timeline for the relocation of the signs. The Design-Build Contractor shall remove, store and relocate the existing panel sign, remove the existing wide flange foundations and install new wide flange foundations for the signs at its new location.

Materials

Foundation removal shall be performed with standard construction equipment and per the requirements of the 2016 INDOT Standard Specifications.

Construction Requirements

The Design-Build Contractor shall contact the Office Administrator of the Indiana Logo Sign Group at the address below a minimum of five business days prior to the preconstruction meeting for this project and a minimum of five business days before relocation of the signs begins.

Indiana Logo Sign Group
600 East 96th Street
Indianapolis, IN 46240
Contact: Lulu Rose, Office Administrator (317) 202-1690, Ext. 7012
Toll Free: 1-800-950-1093, Ext. 7012
Fax:(317) 495-9883

Throughout the course of the project, the Design-Build Contractor shall supply bimonthly updates to the Indiana Logo Sign Group Office Administrator updating on the projected timeliness of the sign relocations.

ATTACHMENT 11-1

UNIQUE SPECIAL PROVISIONS

Maintenance of Traffic

A. Automated Work Zone Information System

AUTOMATED WORK ZONE INFORMATION SYSTEM

Description

This item shall consist of furnishing, installing, relocating, operating, servicing, and removing various components of a temporary automated, quickly deployable, portable, real time work zone information system, WZIS, in accordance with 105.03 and as specified herein. Design-Build Contractor shall also provide the maintenance of the complete system for the duration of the Project or as directed by the Engineer.

Materials

Materials shall be in accordance with 801.02 and as follows: All materials used shall meet the manufacturer's specifications and recommendations. Design-Build Contractor shall maintain an adequate inventory of parts to support maintenance and repair of the WZIS.

Design-Build Contractor shall maintain this system and shall be locally available to service and maintain system components, move portable devices as necessary and respond to emergency situations. Design-Build Contractor shall have oversight responsibility for directing placement of devices in the project area. Design-Build Contractor shall be accessible seven days a week and twenty-four hours a day while the system is deployed. Design-Build Contractor shall provide contact information for the system coordinator and others responsible for maintenance of the system prior to installation of the system. Design-Build Contractor shall furnish an on-site System Coordinator for monitoring the WZIS throughout all periods of deployment.

Design-Build Contractor shall furnish a system capable of providing advance traffic information to motorists when there is a slowing of traffic due to congestion resulting from lane reductions or other conditions. The condition-responsive notification to the motorist occurs with the use of Portable Changeable Message Signs, PCMS, in accordance with 801.15, activated through real-time traffic data collected downstream of the PCMS location. This equipment shall be a packaged system that operates as a stand-alone WZIS meeting this specification. Conditions might exist that require multiple deployments of this system at a given time. The Department reserves the right to terminate this item at any time if it determines this WZIS is not performing in accordance with this specification or Design-Build Contractor has not met the responsibilities identified in this specification.

Design-Build Contractor shall provide a WZIS that consists of the following field equipment: portable vehicle detection devices and PCMS's. Design-Build Contractor shall provide a system capable of withstanding inclement weather conditions while continuing to provide adequate battery power. The system must calculate and notify drivers via PCMS's of the traffic delay conditions ahead. All message dialogs are to be approved by the Engineer prior to use. The number and location of detection, and message trailers are defined in the plans and as directed by the Engineer. The decision to deploy or relocate field equipment is made by the Engineer and instrumented through the System Coordinator. The decision for equipment removal is made by the Engineer after Work is complete.

The detector shall be capable of collecting traffic speed data. The processed data is used to remotely control PCMS's to display user definable, Engineer approved and locally stored messages. The message trigger state thresholds are user configurable. The PCMS shall be in accordance with

801.15, with the additional capability of supporting communications via modem/radio/CDMA/GPRS for remote message management.

Construction Requirements

All communication costs including cellular telephone service, FCC licensing, wireless data networks, satellite and internet subscription charges, and battery charging and maintenance. Additional to these requirements, Design-Build Contractor shall assume all responsibility for any and all damaged equipment due to crashes, vandalism, and adverse weather that may occur during the contract period.

The WZIS shall operate continuously when deployed on the project. The system is in a constant "data collection" mode. Design-Build Contractor shall provide technical support for the WZIS for all periods of operation.

In the event that communication with any field equipment is lost; provide a means and staff to manually program a PCMS message. If communication is lost for more than 10 consecutive minutes, the system shall revert to a fail-safe ROAD/WORK/AHEAD message displayed on the PCMS(s) until communications is restored.

System Operator local control functions and remote management operations must be password protected.

The WZIS shall be capable of acquiring traffic information and selecting messages automatically without operator intervention after system initialization. The lag time between changes in threshold ranges and the posting of the appropriate PCMS message(s) shall be no greater than 60 seconds. The system operation and accuracy must not be appreciably degraded by inclement weather or degraded visibility conditions including precipitation, fog, darkness, excessive dust, and road debris.

The system shall be capable of storing ad-hoc messages created by the System Coordinator and logging this action when overriding any default or automatic advisory message.

The WZIS communication system shall incorporate an error detection/correction mechanism to insure the integrity of all traffic conditions data and motorist information messages. Any required configuration of the WZIS communication system shall be performed automatically during system initialization.

Pre-deployment system acceptance is based on the successful performance demonstration of WZIS for a 5 day continuous period in accordance to this specification and as set forth in the plans. Ensure compliance to all FCC and Department specifications.

Equipment Maintenance

Design-Build Contractor shall maintain system components in good working condition at all times. Design-Build Contractor shall repair or replace damaged or malfunctioning components, at no cost to the Department, as soon as possible and within 12 hours of notification by the Engineer. Design-Build Contractor shall periodically clean PCMS.

Method of Measurement

Automated Work Zone Information System including detectors, data communications system and all supporting field equipment will be measured by each detector for the WZIS installed, maintained and removed.

Portable changeable message signs will be measured in accordance with 801.17.

Basis of Payment

Automated Work Zone Information System including detectors, data communications systems and all supporting field equipment, including portable changeable message signs, are incidental to the contract lump sum price. This shall include furnishing all labor, equipment and materials for the installation, maintenance and removal of detectors and supporting field equipment.

ATTACHMENT 13-1

UNIQUE SPECIAL PROVISIONS

Structures

A. Existing Overlay Removal, Hydrodemolition and Latex Modified Concrete Overlay for Bridge Deck 1
B. Structural Mass Pour Concrete 5
C. Embedded Galvanic Anodes 11
D. Compression Type Seal 14
E. Fiber Wrap Concrete Casing System 15
F. Noise Barrier Fire Hydrant Access Door Feature 20
G. Precompressed Foam Joint 21

EXISTING OVERLAY REMOVAL, HYDRODEMOLITION AND LATEX MODIFIED CONCRETE OVERLAY FOR BRIDGE DECK

Description:

This Work shall consist of the removal of the existing bridge deck overlay followed by preparation of the exposed bridge deck surface in accordance with 722, and shall involve milling and the use of hydrodemolition. Subsequent to the deck preparation, the Work shall consist of constructing a latex modified portland cement concrete overlay.

Materials

Materials shall be in accordance with 722.02 and as follows.

Evaporation retardant shall be one of the products listed below. A Type D certification in accordance with 916 shall be furnished to INDOT prior to use.

1. MasterKure ER 50, manufactured by BASF
2. Sika-Film, manufactured by Sika Corporation
3. Eucobar, manufactured by Euclid Chemical Company

Storage and Handling of Materials

Storage and handling of materials shall be in accordance with 722.03.

Construction Requirements

Construction Requirements shall be in accordance with the following.

Removal of Existing Concrete Overlay

When an existing deck overlay is to be removed, the removal shall be performed with a milling machine. Removal in areas that are inaccessible to the milling machine, shall be done by chipping hammers or hand chipping.

Deck Scarification

The deck surface shall be scarified by surface milling to an initial depth of ½ inch or as otherwise shown in Plans. The milling operation shall be limited to the portion of the deck that is closed to traffic at any one time. After the initial surface milling, additional milling may be required as directed.

Surface milling shall be performed with a milling machine capable of removal to the required depth. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine by referencing the existing bridge deck by means of a ski or matching shoe.

If the milling operation results in the snagging of the top mat of reinforcing bars, the milling operation shall be stopped and the depth of removal adjusted. Any damaged reinforcing bars shall be repaired as directed at no additional cost.

Hydrodemolition

Hydrodemolition shall be used to remove all unsound concrete in accordance with 722.05(a)2. The hydrodemolition equipment shall consist of a self-propelled computerized machine that utilizes a high pressure water jet stream capable of removing concrete as specified herein, as well as removing rust and concrete particles from exposed reinforcing bars. The hydrodemolition equipment shall be calibrated and approved prior to use.

Prior to hydrodemolition, the equipment shall be calibrated on an area of sound original deck concrete as designated by INDOT.

The initial settings shall be verified on an area of unsound concrete. The initial settings may need to be adjusted in order to achieve total removal of unsound concrete. Calibration of the hydrodemolition equipment shall be conducted for every day of operation and, if necessary, re-calibrated to ensure removal of known areas of delaminated concrete as well as to guard against removal of sound concrete. INDOT shall be notified of the final equipment settings resulting from the calibration process.

After calibration of the equipment, concrete removal by hydrodemolition shall be conducted on the bridge deck. The removal will be verified as necessary, every 30 Ft. along the cutting path. Hand chipping shall be used in areas that are inaccessible to the self-propelled hydrodemolition equipment. Hand chipping tools may be hand or mechanically driven and operated

The Design-Build Contractor shall submit a waste water control and disposal plan for approval prior to commencing hydrodemolition activities. The waste water control and disposal plan shall detail how all waste water generated by the hydrodemolition activities shall be contained, tested for pH, stored and transported to a disposal facility in accordance with 202.

The Design-Build Contractor shall provide shielding to ensure containment of all dislodged concrete during hydrodemolition operations to prevent damage to surrounding property and from flying debris both on and under the work site.

Cleaning of the hydrodemolition debris and slurry shall be performed with a vacuum system equipped with fugitive dust control devices and capable of removing wet debris and water in the same pass. The vacuum equipment shall be capable of washing the deck with pressurized water during the vacuum operation to dislodge all debris and slurry from the bridge deck surface. Debris and slurry shall not be allowed to dry prior to vacuuming.

Additional Unsound Concrete Removal After Hydrodemolition

After hydrodemolition has been completed, the deck will undergo sounding to identify remaining areas of unsound concrete. The deck surface shall be completely dry prior to sounding.

Additional concrete removal will be directed by INDOT and shall be performed by hand chipping or hydrodemolition. Only hand chipping tools shall be used when removing concrete within 1 inch of reinforcing bars.

Where the deck is sound for less than half of its original depth, the concrete shall be removed full depth except for limited areas as determined by INDOT. Forms for areas of up to 4 square feet may be suspended from wires

attached to the reinforcing bars. For areas greater than 4 square feet, the forms shall be supported from the structural members of the superstructure or by shoring from below.

Where reinforcing bars have been exposed and the bond between the existing concrete and the reinforcing bars has been destroyed, the concrete adjacent to the reinforcement shall be removed to a minimum clearance of 1 inch around the circumference of the exposed reinforcement.

Where reinforcing bars have been exposed and the concrete in contact with reinforcing bars is sound, the additional removal of 1 inch around the circumference of the exposed reinforcing bars may be waived by INDOT.

Any damaged reinforcing bars shall be repaired as directed at no additional cost. The removal area shall be cleaned of all dirt, foreign materials and loose concrete to the extent necessary to produce a firm solid surface for adherence of the new concrete. A minimum 1 inch vertical surface shall remain, or be cut 1 inch, outside and around the entire periphery of each full depth removal area after removal of all loose and unsound concrete. The 1 inch vertical cut may be waived if it is determined that a cut will damage the reinforcing bars.

Preparation of Bridge Floor Prior to Overlay Placement

After completion of hydrodemolition and any additional concrete removal, the deck shall be sounded to ensure that all unsound concrete has been removed. Not more than 24 hours prior to the placement of the overlay, the deck shall be cleaned in accordance with 722.05(b) and as follows. Water blasting may be used in lieu of sandblasting. The sandblasting or water blasting shall be performed using two passes with the second pass being at a right angle to the first pass or a cross-blasting technique. The minimum pressure of the water blast shall be 7,500 psi.

Patching of the Bridge Floor

Full depth patching of the bridge floor shall be in accordance with 722.06(a).

Proportioning and Mixing

Proportioning and mixing of the latex modified concrete shall be in accordance with 722.04 and 722.08, respectively.

Placing and Finishing

Placement and finishing of the latex modified concrete overly shall be in accordance with 722.09 except that a bond coat shall not be applied to surfaces where the removal was accomplished by hydrodemolition. Evaporation retardant shall be applied in accordance with the evaporation retardant manufacturer’s recommendations to the surface of the latex modified concrete immediately after every second transverse pass of the burlap or pan drag on the finishing machine is completed. Reapplication of the evaporation retardant shall be performed to all areas where the surface has been disturbed after the application of the evaporative retardant, such as from bull floating or hand finishing, or when drying of the surface is observed. The evaporation retardant shall be used as such and not as a finishing aid. Excessive amounts shall not be applied and worked into the latex modified concrete surface.

Texturing and Curing

Texturing and curing shall be in accordance with 722.10 and 722.11, respectively. When a portion of the grooving or tining, not to exceed 5 feet longitudinally, is complete, the evaporative retardant shall be re-applied to the freshly textured surface.

Calibration of Continuous Mixers

Calibration of continuous mixers shall be in accordance with 722.12.

Waste Water Control and Disposal

The waste water control and disposal plan, waste water containment, testing, storing, transporting and disposal, and any incidentals related to the carrying out of the plan shall be included in this Work. If the waste water is found to have a pH of 12.5 or higher it will be classified as hazardous and must be treated accordingly.

Construction

The initial equipment calibration, any re-calibration, equipment shielding, handchipping curb areas, handchipping unsound concrete, cleaning of debris and slurry, compressed air cleaning, water blasting, and sandblasting shall be included in this Work.

STRUCTURAL MASS POUR CONCRETE

Description

This Work shall consist of furnishing and placing a concrete structural element, of large cross section, that is free of cracks resulting from thermal gradients created by the heat of hydration during the curing process in accordance with 105.03, the Design Documents, and as described herein. This shall be accomplished through appropriate mix design and management of the concrete temperature and temperature differential. Structural mass pour concrete is defined as any concrete placements with a least dimension greater than 5 feet and as indicated on the Design Documents. This specification shall not apply to concrete placed in drilled shafts.

Materials

The mass pour concrete structural element shall utilize Class A concrete in accordance with 702.02 and 702.03, except as follows:

1. The coarse aggregate shall be size No. 5 or No. 8. An AASHTO M 43 size coarse aggregate meeting the gradation requirements of #467, #4 or #357 may be used if approved by INDOT. In addition, the minimum clearance between reinforcing bars shall be at least 1.5 times the nominal maximum size of the coarse aggregate.

2. Cooling of materials prior to addition to the mixer will be allowed to reduce the temperature of the concrete in its plastic state. The normal practices as identified in ACI 207.4R – 05 are considered acceptable for pre-cooling materials prior to and at the time of concrete batching.

3. Concrete designated as sulfate resistant on the Design Documents shall incorporate one of the following options for materials and proportioning.

   a. Use a Type V portland cement meeting the requirements of AASHTO M 85, from a source on the Department's list of approved cement sources. Proportioning of the Class A mix shall be in accordance with 702.02 and 702.05 except that cement reduction and replacement with a pozzolan is not allowed.
   b. Use a Type II portland cement. Proportioning of the Class A mix shall be in accordance with 702.02 and 702.05 except that the water/cementitious ratio shall not exceed 0.450.
   c. A Type I Portland cement and a fly ash may be used. Proportioning of the Class A mix shall be in accordance with 702.02 and 702.05 except that the water/cementitious ratio shall not exceed 0.440. In addition, the cement shall be tested in combination with the fly ash to establish sulfate resistance according to Procedure A, in Table 4 of AASHTO M 295. The tested material shall meet the requirements for moderate sulfate resistance. Approval will be based on a Type A Certification in accordance with 916.02, except that the samples of cement and fly ash do not have to be from material shipped to the contract. The cement and fly ash used to evaluate sulfate resistance shall be tested for compliance with AASHTO M 85 and M 295, respectively; and the results reported with the Type A certification.

Cement used in the job concrete shall have a C_3A content that does not exceed the amount determined for the cement sample tested for sulfate resistance or 10 percent, whichever is lower.

Thermal Control

The maximum concrete temperature at time of placement shall not exceed 70 degrees Fahrenheit and shall not be less than 40 degrees Fahrenheit. The maximum concrete temperature during the period of heat dissipation shall not exceed 150 degrees Fahrenheit. The temperature differential between the interior of the section and the outside surface of the section shall not exceed the limits specified in the following table:

Hours After Placement Hours	Maximum Temperature Differential °F
0-24	20
24-48	30
48-72	40
>72	50

Thermal control of each placement shall be maintained until the temperature of the interior is within 50 degrees Fahrenheit of the average outside air temperature. The average outside air temperature shall be determined by averaging the daily high and low temperature of the preceding seven calendar days.

Thermal Control Plan

A thermal control plan shall be written to describe the procedures used during the period of heat dissipation following concrete placement. The thermal control plan shall describe the procedures used to ensure that the maximum temperature and temperature differential between the interior of the section and the outside surface of the section do not exceed the restrictions specified. The thermal control plan shall be submitted to INDOT at least 30 days before the first intended structural mass pour concrete placement. Compliance with this specification may result in long cooling times. Therefore, consideration shall be given to options that control heat of hydration that are compatible with the desired construction schedule and erection procedures.

Mass pour concrete shall not be placed until the thermal control plan has been approved by INDOT, and the equipment and materials necessary to facilitate the plan are on site and ready for use.

For mass pour concrete placements, the thermal control plan shall be developed by a Registered Professional Engineer in the State of Indiana who is competent in the modeling, design, and temperature control of mass pour concrete in structural elements. The Registered Professional Engineer shall be known as the Thermal Control Engineer (TCE). The TCE shall be knowledgeable of Section 207.02R-95 of the ACI Manual of Concrete Practice entitled "Effect of Restraint, Volume Change and Reinforcement on Cracking of Mass Concrete". The TCE shall follow the guidelines outlined in Section 207.4R-05 of the ACI Manual of Concrete Practice entitled "Cooling and

Insulating Systems for Mass Concrete" to formulate, implement, administer, and monitor a thermal control plan.

The TCE shall have administered at least three mass pour concrete projects of similar dimension and thermal control requirements to those shown on the Design Documents and the projects shall have been completed within the past three years. The TCE shall be responsible for making adjustments as necessary to ensure compliance with these specifications.

The thermal control plan shall include, but is not limited to the following:

1. The mix design for the mass pour concrete.

2. The adiabatic heat generation for the mix design being used. This shall be determined by laboratory testing in accordance with ASTM C186.

3. Identification of any modeling software used to predict maximum temperature and temperature differential resulting from the heat of hydration generated in mass pour concrete.

4. Methods to monitor and control the maximum temperature and the temperature differential temperature within the concrete to prevent thermal cracking. Method(s) of curing and a remedial action plan shall be defined.

5. List at least three mass pour concrete projects of similar dimension and thermal control requirements to those shown on the Design Documents. The projects must have been administered by the TCE and must have been completed within the past three years. The list of projects shall include the names and phone numbers of the owner's representative who can verify the TCE's participation on those projects.

6. Qualifications of all technicians employed to inspect or monitor mass pour concrete placements.

7. If necessary, design of a post-cooling system consisting of non-corrosive piping to be embedded in the structural mass. Details of the grouting operations shall be provided. The grout shall be a pre- packaged material and shall be identified in the plan.

8. Provide information on the temperature sensing and recording equipment to be used and the details of the installation and location of the temperature probes for each planned mass pour concrete placement.

9. Details of mass pour concrete placement to ensure prevention of cold joints during placement.

Temperature Sensing and Recording

For each placement of structural mass pour concrete, two temperature sensors shall be installed at each of the following five locations (for a total of ten temperature sensors). Additional sensors may be installed at

other locations within the concrete placement, as required and detailed in the thermal control plan.

- Center of the placement.
- Midpoint of the side which is the shortest distance from the center, having 2 to 3 inches of cover.
- Midpoint of the top surface, having 2 to 3 inches of cover.
- Corner of the placement which is furthest distance from the center, having 2 to 3 inches of cover.
- Air temperature.

The purpose of the two sensors at each location is to provide a primary sensor and secondary back up sensor. A back-up readout device for the sensors shall also be provided. The back-up system is intended to be used to complete the monitoring of a placement should the primary system fail.

Temperatures shall be electronically recorded automatically by a recorder furnished by Developer. The equipment shall be capable of continuously recording at least one reading every 30 minutes for the duration of the mass concrete temperature monitoring period. The sensors and recorder shall be accurate to within ± 2 degrees Fahrenheit in the temperature range of the 32 degrees Fahrenheit to 212 degrees Fahrenheit.

Production

The TCE, or qualified technician employed by the TCE, shall personally inspect and approve the installation of monitoring devices and verify that the process for recording temperature data is effective for the first placement of each size and type of mass pour concrete component. Recording of temperature data shall begin when the mass pour concrete placement is complete and shall continue past the maximum temperature differential (not maximum temperature) and a decreasing temperature differential is confirmed for compliance with these specifications. For placements other than the first, a qualified technician may inspect and monitor the temperature sensing and recording system for the purpose of:

1. Reviewing temperature data.
2. Being in contact with the TCE should adjustments be made as a result of the temperature differential being exceeded.
3. Implement adjustments to temperature control measure as directed by the TCE.
4. If conditions change, such as a drop in the ambient temperature or a change in insulation resulting in an increase in the temperature differential, the recording of the temperature data shall be resumed. A copy of all recorded temperature data shall be furnished to INDOT as they are determined.

The TCE or qualified technician shall report temperature data at intervals not exceeding four hours. The TCE shall furnish INDOT a final report within three days of completion of monitoring of each structural element. The report shall include all recorded temperature data and pertinent information and actions taken to implement the thermal control plan.

If the maximum concrete temperature or differential temperature within the structural mass pour concrete placement exceeds the specified limits, immediate corrective action as directed by Developer or the TCE shall be taken. Future placement of structural mass pour concrete will be suspended and a revised thermal control plan shall be submitted to INDOT. Further placement of mass pour concrete shall not occur without written notice from INDOT.

Acceptance

Application of loads and acceptance of concrete shall be in accordance with 702.24, except that sulfate resistant concrete will be tested for compliance based on flexural strength of beam specimens. ITM 402 may be used as an alternate method to determine flexural strength.

If the maximum temperature of the mass pour concrete after placement exceeds 150 degrees Fahrenheit, but is less than 160 degrees Fahrenheit, the concrete will be accepted if no cracking or other unacceptable defects are identified. If cracking or unacceptable defects are identified, the mass pour concrete will be adjudicated as a failed material in accordance with 105.03. If the maximum concrete temperature equals or exceeds 160 degrees Fahrenheit, the mass pour concrete will be adjudicated as a failed material in accordance with 105.03.

If a temperature differential between the internal center of concrete placement and the concrete 2 to 3 inches from the exposed surface exceeds the specified amount, the concrete will be accepted if no cracking or other unacceptable defects are identified. If cracking or unacceptable defects are identified, the mass pour concrete will be adjudicated as a failed material in accordance with 105.03.

The concrete shall be inspected for cracks after the temperature monitoring is discontinued. Developer shall provide access for inspection. Developer shall be responsible for repair of cracks identified. A clear concrete sealer shall be applied in accordance with 709 to a crack that is less than 0.007 inches in width. A crack that is 0.007 inch or greater in width shall be repaired by epoxy injection in accordance with 727.

EMBEDDED GALVANIC ANODES

Description

This Work shall consist of the installation of galvanic anodes directly to the existing cleaned reinforcing bars as a means of corrosion protection. The galvanic anodes shall be installed along the concrete deck widening interface as described herein, or by the manufacturer. This Work includes furnishing all labor, tools, materials, equipment and services necessary to properly install embedded galvanic anodes.

Embedded galvanic anodes are designed to provide localized corrosion protection. When placed at the appropriate spacing along the perimeter of concrete patches or along the interface between new/existing concrete, the anodes mitigate active corrosion and the formation of new corrosion sites in the adjacent existing concrete.

Reference shall be made to the following:

5. ACI/ICRI Concrete Repair Manual
6. ACI Guideline No. 222 – Corrosion of Metals in Concrete
7. ACI Repair Application Procedure (RAP) Bulletin 8 – Installation of Embedded Galvanic Anodes (2010)
8. ICRI Guideline 310.1R-2008 Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion
9. ASTM B418-12 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes

Materials

Embedded Galvanic Anodes

Embedded galvanic anodes shall be Anode "Type 1A Class C" with the following approximate dimensions: 3 inches long by 3 inches wide by 2 inches deep. The anodes shall be pre-manufactured with a minimum 100 grams of zinc in compliance with ASTM B418 Type II cast around a pair of uncoated, non-galvanized steel tie wires and encased in a highly alkaline cementitious shell.

The galvanic anodes shall be alkali-activated and shall contain no intentionally added chloride, bromide or other constituents that are corrosive to reinforcing bars as per ACI 562-13. Anode units shall be supplied with integral unspliced wires for directly tying to the reinforcing bars. Embedded galvanic anodes shall be one of the following:

1. Galvashield® XP2 available from Vector Corrosion Technologies (www.vector-corrosion.com) USA. Contact: Eric Thorpe, (720) 236-5910.
2. SENTINEL SILVER® available from Euclid Chemical (www.euclidchemical.com) 19218 Redwood Road, Cleveland, OH 44110. Phone: (800) 321-7628.

3. EMACO CP® Intact 105G from BASF North America http://www.master-builders-solutions.basf.com/en-basf/Pages/ContactForm.aspx Phone: (800) 526-1072.

Application for approved equals shall be requested in writing. Application for galvanic anode approved equals shall include verification of the following information:

1. The zinc anode shall be alkali-activated with an alkaline cementitious shell.

2. The galvanic anode shall contain no intentionally added constituents corrosive to reinforcing bars, e.g. chloride, bromide, etc.

3. The anode manufacturer shall provide documented test results from field installations showing that the anodes have achieved a minimum of 10 years in service.

4. The galvanic anode shall have been used in a minimum of ten projects of similar size and application.

5. The galvanic anode units shall be supplied with solid zinc core (ASTM B418) cast around uncoated, non-galvanized, non-spliced steel tie wires for wrapping around the reinforcing bars and twisting to provide a durable steel to steel connection between the tie wire and the reinforcing bars.

6. The anode manufacturer shall provide third party product evaluation, such as from Concrete Innovations Appraisal Service, BBA, etc.

Repair Materials

Anodes shall be embedded in fresh concrete. If repair mortars, concrete or bonding agents should become necessary, they shall be portland cement-based materials with suitable electrical conductivity less than 15,000 ohm-cm. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted. Repair materials with significant polymer modification and/or silica fume content may have high resistivity. Insulating materials such as epoxy bonding agents shall not be used unless otherwise called for in the design.

If higher resistance repair materials are used other than concrete, the Design-Build Contractor shall use an embedding mortar or as otherwise directed by manufacturer to create a conductive bridge to the substrate prior to repair material installation.

Storage

The Design-Build Contractor shall deliver, store, and handle all materials in accordance with manufacturer’s instructions. Anode units shall be stored in dry conditions in the original unopened containers in a manner to avoid exposure to extremes of temperature and humidity.

Construction Requirements

Concrete Removal

The Design-Build Contractor shall remove concrete areas in accordance with Plans and 202.

The Design-Build Contractor shall undercut all exposed reinforcing bars by removing concrete from the full circumference of the bars as per ICRI R310.1R. The minimum clearance between the concrete substrate and reinforcing bars shall be ¾ inch (19 mm) or ¼ inch (6 mm) larger than the top size aggregate in the repair material, whichever is greater.

Cleaning and Repair of Reinforcing Bars

The Design-Build Contractor shall clean exposed reinforcing bars of rust, mortar, etc. to provide sufficient electrical connection and mechanical bond.

If significant reduction in the cross section of the reinforcing bar has occurred, the Design-Build Contractor shall replace or install supplemental reinforcement as directed by the engineer of record.

The Design-Build Contractor shall secure loose reinforcing bars by tying tightly to other bars with steel tie wire.

The Design-Build Contractor shall verify electrical continuity of all reinforcing bars, including supplemental bars, as per Section 9.3.3.c.5) below.

If the reinforcing bars are to receive a barrier coating, the Design-Build Contractor shall not coat the reinforcing bars within 1inch (25mm) of the anode and shall not apply coating to any surface of the anode or the steel tie wires.

Galvanic Anode Installation

The Design-Build Contractor shall install anode units and repair material immediately following preparation and cleaning of the reinforcing bars.

Galvanic anodes shall be installed along the interface between new and old concrete in a pattern alternating between top and bottom bars throughout the entire structure length. Spacing shall be as recommended by manufacturer but not to exceed 30 inches.

The Design-Build Contractor shall place the galvanic anodes as close as possible to the concrete interface while still providing sufficient clearance between anodes and existing concrete to allow the new concrete to fully encase the anode with a minimum concrete or mortar cover over the anode of 1 inch (25mm).

The Design-Build Contractor shall place the anode such that the unit fits along a single bar or at the intersection between two bars and secure to each clean bar.

If less than 1 inch (25 mm) of concrete cover is expected, the Design-Build Contractor shall place anode beneath the bar and secure to clean reinforcing steel.

The tie wires shall be wrapped around the exposed cleaned reinforcing bars at least one full turn in opposite directions and then twisted tight to create a secure electrical connection and allow no anode movement during concrete placement.

Electrical Continuity

The Design-Build Contractor shall confirm electrical connection between anode tie wire and reinforcing bars by measuring DC resistance (ohm) or DC potential (mV) with a multi-meter.

The Design-Build Contractor shall confirm electrical continuity of the exposed reinforcing bars within the repair area. If necessary, electrical continuity shall be established by tying discontinuous bars to continuous bars using steel tie wire.

Electrical continuity acceptance levels shall be in accordance with manufacturer's recommendations.

Manufacturer Corrosion Technician

The Design-Build Contractor shall enlist and pay for a technical representative employed by the galvanic anode manufacturer to provide training and on-site technical assistance during the initial installation of the galvanic anodes.

The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic protection systems for reinforced concrete structures.

The Design-Build Contractor shall coordinate its Work with the designated corrosion technician to allow for site support during Project startup and initial anode installation. The corrosion technician shall provide Design-Build Contractor training and support for development of application procedures, verification of electrical continuity, and Project documentation.

COMPRESSION TYPE SEAL

Description

This Work shall consist of the removal and replacement of an existing structural expansion joint with a compression seal joint of the type shown on the Plans and in accordance with these requirements.

Materials

Materials shall be in accordance with ASTM D 3542. The dimension and tolerance requirements shall be as specified by the manufacturer. The material shall be covered by a Type A certification in accordance with 916 and sampling of the material will be required. Satisfactory test results shall be obtained from the sample prior to the installation of the seal. The lubricant-adhesive shall be covered by a Type C certification in accordance with 916.

Construction Requirements

All metal surfaces in direct contact with the seal shall be cleaned and properly treated in accordance with the manufacturer's recommendations. Lubricants and adhesives shall be used in accordance with the joint manufacturer's recommendations. All excess lubricant and adhesive shall be removed before it has set.

Final adjustments of the assembly shall be made as directed at the time of installation. All movements due to such factors as shrinkage, creep, and midslab deflection shall be accounted for prior to this final adjustment.

The existing joint and adjacent concrete shall be removed to the limits shown on the Plans. Additional removal, as directed by INDOT, may be required to encounter sound concrete adjacent to the joint area. The replacement seal shall be in accordance with the requirements contained herein for the specified type. Concrete shall be Class C in accordance with 702.

FIBER WRAP CONCRETE CASING SYSTEM

Description

This work shall consist of cleaning existing concrete surfaces, removing deteriorated concrete, corrosion, or other deleterious substances, patching existing concrete surfaces and providing a field-applied reinforced concrete encasement system using an externally bonded glass fiber reinforced polymer, FRP, composite system in accordance with 105.03. The FRP composite system shall be field applied to the existing concrete piers as shown on the plans.

Materials

The materials and installation direction for this work shall be supplied by one of the following manufacturers:

1. Fyfe Co. LLC
2. Quakewrap, Inc.
3. Sika Systems

Materials used to repair or patch portions of the concrete structural member, or to restore the concrete structural member to the section shown on the plans shall be as recommended by the manufacturer of the fiber reinforced system.

Materials shall be delivered to the project site in factory-sealed containers with the manufacturer's labels intact and legible with verification of date of manufacture and shelf life. Products shall be stored according the manufacturer's requirements and shall be protected from contact with moisture. All Materials supplied shall have a Type B certification in accordance with 916.

Submittals

The following items shall be submitted by the Contractor prior to beginning this work:

1. ASTM E84 flame and smoke test results. The minimum of a Class 1 rating for the system shall be provided.
2. Independent test report showing system environmental durability on the proposed composite to be used; including a minimum of 10,000 hour resistance to salt water, alkali soil, and 100% humidity. Material shall maintain design properties as described herein.
3. Freeze-thaw resistance tests with a minimum of 20 cycles. Material shall maintain design properties as described herein.
4. Certification from the manufacturer of the system's material properties including previously completed ASTMD3039 test results of the proposed system.
5. Complete working drawings containing details of the number and thickness of layers, joint and end details and locations to satisfy project requirements.

6. Applicator project references from at least 10 previously completed projects using the proposed FRP system in the last two years.

7. The names of at least three individuals who have been certified and trained by the FRP system manufacturer and who will be on site during all phases of the project.

8. Written certification from the composite system manufacturer showing the names of at least three trained personnel who will be on the jobsite during all phases of the installation.

9. A list of at least two different qualified testing laboratories that can perform the required ASTM D3039 tests as per this specification.

The Contractor shall receive written approval of his plan and personnel prior to beginning work.

Construction Requirements

The portions of the concrete structural members to be repaired shall be cleaned. Deteriorated, delaminated, or otherwise unsound concrete and other deleterious substances shall be removed and the portions of the concrete structural members to be repaired shall be restored to their original cross sectional shape or to the shape shown on the plans prior to installing the fiber reinforced composite system.

The fiber reinforced composite system shall be field applied to the concrete areas shown in the plans.

This work shall be performed by an applicator with proven past experience applying the approved composite system for a minimum of 10 projects in the past two years. The applicator shall supply the names of at least three individuals who have been certified and trained by the FRP system manufacturer and who will be on site during all phases of the project. The Engineer will have the right to approve or reject the personnel qualifications as submitted. The Engineer may suspend the work if the Contractor substitutes unauthorized personnel for authorized personnel during construction.

The composite system applicator shall submit a written description of the proposed epoxy, including VOC levels, and a complete written description of the application procedures for review by the Engineer. The applicator shall be certified by the manufacturer and provide a quality control procedure in accordance with this specification.

The supply and installation of the composite system shall meet the performance criteria of this specification and as stated on the contract drawings.

This work shall be completed per manufacturer requirements.

Field Quality Control Procedures

The application and testing of this work shall be done in accordance with the following field quality control procedures:

Installers

Installers shall record batch numbers for fabric and epoxy used each day, and note locations of installation. The square footage of fabric and volume of epoxy used each day shall be measured and the complete report shall be submitted to the Engineer and the system manufacturer.

Inspection

A manufacturer's representative shall periodically observe all aspects of preparation, mixing, and application of materials, including the following:

1. Material container labels
2. Surface preparation
3. Mixing of epoxy
4. Application of epoxy to the fiber
5. Application of composite system
6. Curing of composite material
7. Preparation and labeling of test samples
8. All adhesion (ASTM D4541) testing, if required
9. Visual inspections and sounding of the installed composite

The composite casing shall be completely inspected by the manufacturer's representative during and immediately following application of the composite. The Contractor shall monitor the mixing of all epoxy components for proper ratio and adherence to manufacturer's recommendations.

Visual Inspection and Sounding of Installed Concrete

All installed areas shall be visually inspected by the manufacturer's representative. The installed composite shall completely adhere to the concrete substrate with no bubbles or voids. Any suspect areas shall be sounded with a ball peen hammer. A light tapping will indicate the presence of any voids behind the installed composite. All defects shall be reported to the Engineer and repaired as described below in this specification.

Laboratory Testing

The lot number of fabric and resin used, and location of installation shall be recorded. A sample batch shall consist of 2 12 in. by 12 in. samples of cured composite. A minimum of two sample batches shall be made daily. The two sample batches shall be taken at appropriate times during the day so as to ensure the maximum material deviance in the components of the composite. The testing laboratory shall pre-condition samples at 140°F for 48 h before testing. Samples shall be tested, at random, at the owner's discretion and cost.

Tested samples shall be tested per ASTM D3039. The 12 in. by 12 in. panel shall have 5 coupons, 3/4 in. by 9 in., removed and tested for their material properties in the longitudinal, primary fiber, direction. Tests shall conform to ASTM procedures and manufacturer's published testing methods. Only pre-qualified testing laboratories shall be used.

Testing results shall be made available within three weeks of sample submission. The testing shall provide average values of the following:

1. Ultimate tensile strength
2. Tensile Modulus
3. Percent elongation

Fifteen percent of all sample batches shall be tested. If one 12 in. by 12 in. sample fails, specimens from the same sample shall be tested. If these specimens also fail, the other 12 in. by 12 in. from the same sample batch shall be tested. If this sample also fails, the remaining sample batch for that day shall be tested and appropriate remedial measures will be taken, as described herein, to ensure integrity of the system from the failed sample batch. In addition, 25% of the remaining sample batches will then be tested by the same criteria.

Substrate Adhesion Testing

Direct tension adhesion testing of cored samples shall be conducted using the method described by ASTM D4541. A minimum of three tests shall be performed for each day of production or for each 500 sq ft of FRP application, whichever is less.

Pull-off tests shall be performed on a representative adjacent area to the area being strengthened. Tests shall be performed on each type of substrate or for each surface preparation technique used.

The prepared surface with one layer of the bonded FRP system shall be allowed to cure a minimum of 48 hours before execution of the direct tension pull-off test. The locations of the pull-off tests shall be representative and on flat surfaces. If no adjacent areas exist, the tests shall be conducted on areas of the FRP system subjected to relatively low stress during service. The minimum acceptable value for any single tension test is 175 psi. The average of the three tests at each location shall not be less than 200 psi. Additional tests may be performed to qualify the work. The tension adhesion tests shall exhibit failure of the substrate indicated by a layer of concrete or masonry on the underside of the test puck following the test.

Repairs

All defects, including bubbles, delaminations, and fabric tears, spanning more than 5% of the surface area, or as specified by the Engineer, shall be repaired. Two types of repairs shall be performed:

1. Small defects on the order of 3” diameter shall be injected or back filled with epoxy.
2. Large defects shall be repaired as required by this specification and by the manufacturer’s specifications.

Small entrapped air pockets and voids naturally occur in mixed resin systems and do not require repair or treatment. Defect repair shall be provided by the manufacturer and be submitted to the Engineer for approval. Additional payment will not be made for repairs.

Remedial Measures

In the event that material testing determines a sample batch to possess insufficient material properties, remedial measures shall be taken. If the tested composite system has material properties determined to be below the minimum specified values, additional layers shall be installed until the final composite thickness is increased by the same percentage as the deficiency of the material's elastic modulus. Additional payment will not be made for any required additional material.

Complete cleaning, removal of concrete, preparation of the structural member, patching of the structural member, and other incidentals and the fiber reinforced polymer concrete casing system will not be measured for payment.

The cost of all labor, materials, equipment, and necessary incidentals, including scaffolding, testing, preparation of the structural member, application of the FRP system, providing a manufacturer's representative, and the final coating system and repairs shall be included in the lump sum price for this work.

NOISE BARRIER FIRE HYDRANT ACCESS DOOR FEATURES

Description

This Work shall consist of designing, furnishing and installing doors, handles, signs, and raised pavement markers (RPMs).

Materials

The door shall have no locks. The handle shall be of the lever type. Signs and RPMs shall meet the requirements of 919.01 and 921.02 respectively. The door shall have a plunging type deadbolt that is controlled by the highway side lever handle with no key or locking mechanism. An exterior grade closing mechanism shall be included to cause the door to close automatically.

Construction Requirements

One handle shall be placed on the highway side of the fire hydrant access door to make it accessible from the highway side only. The right-of-way side shall not have a handle. The gap between the door's threshold and the bottom of the door shall have enough clearance to accommodate vegetation growth, snow and ice, or any other potential obstructions.

There shall be three signs for each door, mounted on the highway side. The first sign above the door frame shall state, "Fire Hydrant Access". The legend of the second sign, mounted just below the first sign, shall be the street name or highway number of the roadway the hydrant is accessed from. The third sign shall be positioned on the door itself, and shall indicate the perpendicular distance in feet between the nearest point on the highway edge line to the fire hydrant.

A blue RPM shall be installed in the shoulder edge line at the nearest point perpendicular to the door. If existing RPMs are available when the noise barrier is being installed, the nearest shoulder RPM will have the reflector changed to blue.

PRE-COMPRESSED FOAM JOINT

Description

This work shall consist of removal of the existing bridge expansion joint and placement of the new pre-compressed foam joint in accordance with 105.03, at the locations shown on the plans.

Materials

Materials shall be supplied by one of the following:

EMSEAL
25 Bridle Lane
Westborough, MA 01581
www.emseal.com

LymTal International, Inc.
4150 South Lapeer Road
Lake Orion, MI 48359
www.lymtal.com

Watson Bowman Acme Corporation
95 Pineview Drive
Amherst, NY 14228
www.wbacorp.com

Erie Metal Specialties
13311 Main Road
Akron, NY 14001
www.eriemetal.com

Silicone Specialties, Inc.
P.O. Box 50009
Tulsa, OK 74150
www.ssicm.com

Joint shall be attached to the substrate through the use of a two part epoxy adhesive.

Construction Requirements

The location and general appearance of the installed joint shall be as shown on the plans. Additional details shall be in accordance with the manufacturer's drawings. Working drawings, specifications, and other details in accordance with 105.02 shall be provided to the Engineer prior to commencing joint installation.

A qualified representative of the joint manufacturer shall be present at the beginning of the work to ensure adequate workmanship and inspection of the joint installation.

The joint shall be a micro cell, UV stable, hydrophobic foam seal coated with traffic grade, fuel resistant silicone. The joint shall be stable through a temperature range of -40°F to 185°F.

The joint shall be sealed to the substrate with a silicone sealant.

Joints shall be inspected for proper depth, width, alignment and preparation as shown on the plans. Joints shall be cleaned of all old joint

seals, old materials or devices, bituminous material, dirt, grease, and all other deleterious material. The joints shall be cleaned over the total area of the opening to receive the new joint. Preparation shall be as recommended by the manufacturer. All areas to be in contact with the new joint shall be sound, clean, dry, and frost free.

The epoxy material shall be mixed and placed in accordance with the manufacturer's printed instructions. As a witness point, one set of the manufacturer's instruction shall be provided to the Engineer not less than one week prior to the beginning of joint placement.

The joint shall be installed when the temperature is above 60°F or as directed.

Prior to the epoxy curing, the Contractor shall force the tip of the silicone sealant between the substrate and the joint, and inject a corner bead of silicone sealant along the entire length of the joint. The Contractor shall then tool the silicone sealant to blend with the substrate and silicone coating of the joint.

ATTACHMENT 14-1

CERTIFIED S.U.E. DATA

The following parts of this attachment are included as separate files

A. CADD data, SR-2 to US-30
B. Utility Matrix, SR-2 to US-30
C. CADD data, SR-2 to SR-10
D. Utility Matrix, SR-2 to SR-10

Attachment 14-1B

Test Hole Number	Station	Date	Type of Utility	Utility Size	Material of Utility	Cross Section	Utility Direction	Offset	Northing	Easting	Existing Ground Elevation	Top of Utility Field Depth (Feet)	Elevation (Top of Utility)	Quality Level	Surface Type Ground / Paving / Concrete	Surface Thickness (Inches)	Comments
101		12/19/15	Telephone	12"	Duct	⊓	⟷	17.2' LT Edge of Pave	76980.642	94308.905	643.076	5.68'	637.40'	A	Natural Ground	N/A	
102		12/19/15	Telephone	See Note	See Note	See Note	⟷	22.3' LT Edge of Pave	76976.556	94393.269	645.464	7.03'	638.43'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand.
103		12/19/15	Telephone	12"	Duct	⊓	⟷	26.5' RT Edge of Pave	76974.974	94481.585	640.111	4.45'	635.66'	A	Natural Ground	N/A	
104		12/10/15	Gas	See Note	See Note	See Note	⟷	12.4' LT Edge of Pave	63587.024	97416.87	649.267	6.58'	642.69'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Probed both edges.
105		12/10/15	Fiber Optic	See Note	See Note	See Note	⟷	15.5' LT Edge of Pave	58239.078	99323.414	668.267	8.77'	659.50'	B	Natural Ground	N/A	Could not expose utility due to collapsing soil. Could feel both conduits with Air-lance. (2) x 1.5"
106		12/10/15	Fiber Optic	See Note	See Note	See Note	⟷	20' RT Edge of Pave	58252.619	99398.229	668.801	9.03'	659.77'	B	Natural Ground	N/A	Could not expose utility due to collapsing soil. Could feel both conduits with Air-lance. (2) x 1.5"
107		12/10/15	Fiber Optic	See Note	See Note	See Note	⟷	16.8' RT Edge of Pave	58277.852	99555.937	668.448	7.95'	660.50'	B	Natural Ground	N/A	Could not expose utility due to collapsing soil. Could feel both conduits with Air-lance. (2) x 1.5"
108		12/10/15	Gas	6"	Metallic	◯	⟷	14.2' RT Edge of Pave	63589.523	97590.429	648.543	4.37'	644.17'	A	Natural Ground	N/A	
109		12/10/15	Gas	6"	Metallic	◯	⟷	27.5' LT Edge of Pave	63586.616	97509.01	648.772	5.57'	643.20'	A	Natural Ground	N/A	
110		12/14/15	Fiber Optic	See Note	See Note	See Note	⟷	17' RT Edge of Pave	87767.31	94495.452	642.4	11.05'	631.35'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Probed both edges, possibly 4" Metallic Conduit.
111		12/14/15	Pipeline	See Note	See Note	See Note	⟷	17.9' RT Edge of Pave	87785.288	94495.647	642.108	8.25'	633.86'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Jeff Payne with BP claims it is an 8" inside a 12" Steel Casing.
112		12/14/15	Pipeline	See Note	See Note	See Note	⟷	17.5' LT Edge of Pave	87783.474	94332.731	642.473	9.51'	632.96'	B	Concrete	N/A	Could not expose utility due to collapsing sand. Jeff Payne with BP claims it is an 8" inside a 12" Steel Casing.
113		12/14/15	Fiber Optic	See Note	See Note	See Note	⟷	18' LT Edge of Pave	87765.439	94331.858	642.236	13.26'	628.98'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Probed both edges, possibly 4" Metallic Conduit.
114		12/15/15	Fiber Optic	2"	Metallic	◯	⟷	13.7' LT Edge of Pave	48577.871	102360.918	685.801	2.91'	682.89'	A	Natural Ground	N/A	
115		12/15/15	Gas	See Note	See Note	See Note	⟷	15.3' LT Edge of Pave	47799.754	102413.636	690.695	8.56'	682.14'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Probed utility, felt like a 2" PE pipe.
116		12/15/15	Gas	See Note	See Note	See Note	⟷	19.1' LT Edge of Pave	47801.792	102498.984	690.676	9.11'	681.57'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Probed utility, felt like a 2" PE pipe.
117		12/15/15	Gas	See Note	See Note	See Note	⟷	17.7' RT Edge of Pave	47803.765	102577.871	690.406	9.50'	680.91'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand. Probed utility, felt like a 2" PE pipe.
118		12/16/15	Pipeline	See Note	See Note	See Note	⟷	18.3' LT Edge of Pave	96674.871	92950.734	652.668	7.35'	645.32'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand and groundwater. 30" PL per Don Littlefield with Nipsco.
119		12/16/15	Pipeline	See Note	See Note	See Note	⟷	17.1' LT Edge of Pave	96653.028	92954.305	652.576	7.62'	644.96'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand and groundwater. 30" PL per Don Littlefield with Nipsco.
120		12/16/15	Fiber Optic	2"	Metallic	See Note	⟷	21.9' LT Edge of Pave	48571.374	102494.373	686.912	3.76'	683.15'	A	Natural Ground	N/A	
121		12/16/15	Fiber Optic	2"	Metallic	◯	⟷	7.7' RT Edge of Pave	48564.151	102604.265	686.983	3.34'	683.64'	A	Natural Ground	N/A	
122		12/16/15	Pipeline	See Note	See Note	See Note	⟷	16.6' RT Edge of Pave	96682.063	93112.727	651.835	5.64'	646.20'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand and groundwater. 30" PL per Don Littlefield with Nipsco.
123		12/16/15	Pipeline	See Note	See Note	See Note	⟷	16.9' RT Edge of Pave	96698.773	93111.013	651.867	8.04'	643.83'	B	Natural Ground	N/A	Could not expose utility due to collapsing sand and groundwater. 30" PL per Don Littlefield with Nipsco.

Client: HNTB
Vac Truck/Trailer No.: 550-420
SUE Crew: KH, DE, RR
City / County: Lowell / Lake, Newton & Jasper
Location: I-65 (SR-2 to SR-10)
Prepared By: KLC - Date: 1/19/16 Checked By: KFS - Date: 1/19/16
Revised By: Checked By:

Cardno
7988 Centerpoint Dr., Suite 100
Indianapolis, Indiana 46256
317-579-4083

Cardno Project No. - IN02900500
S.U.E. UTILITY MATRIX
HNTB
I-65 (SR-2 to SR-10) Lake, Newton & Jasper County, IN

SHEET NO.

ATTACHMENT 14-2

UTILITY-SPECIFIC REQUIREMENTS

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C. Buckeye Requirements……..18
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ANR REQUIREMENTS

TransCanada
In business to deliver

GENERAL GUIDELINES

Work within the TransCanada right-of-way shall be performed in accordance with TransCanada procedures to protect the safety of TransCanada facilities and that of the general public. The following guidelines, although not all inclusive, are provided in order to assist you in your project planning. THESE GUIDELINES ARE NOT TO BE CONSIDERED APPROVAL FOR CONSTRUCTION ACTIVITY WITHIN OUR RIGHT-OF-WAY OR NEAR OUR PIPELINES. Specific guidelines, and crossing agreement if applicable, will be provided to you upon completion of a review of your final plans by our Pipeline Integrity Group Engineer. The following are some of our general guidelines:

1. No ground disturbance shall be made within TransCanada's right-of-way or within 25 ft., measured at right angles, of our pipeline(s) except in the presence of our company representative.

2. Notice of at least seventy-two (72) hours in advance of construction must be provided. You must contact a TransCanada field representative at a number to be provided. Please note that voice messages do not constitute 72 hour notice. Person to person contact must be made. TransCanada will arrange for a representative to be on site when work is occurring on or near the right-of-way area, or within 25 ft. of the pipelines. After hours call 1-800-447-8066.

3. You or your contractor must hydro-vac or hand expose TransCanada's buried pipeline(s) prior to use of mechanical equipment within 15 ft. of the pipeline(s).

4. No sidecutters may be used.

5. No part of powered equipment shall come within three ft. of TransCanada's pipelines, or according to applicable State or Federal requirements.

6. No bucket, any attachment or load may be swung over TransCanada's pipeline(s) where there is less than 24 inches of cover.

7. Buried utilities should be designed to have at least eighteen (18) inches of clearance between their installed position and TransCanada's pipeline(s). As far as practicable, all buried utilities are to cross TransCanada's pipeline(s) at right angles.

8. Proposed buried facilities where the function of the facility is reliant upon the elevation or slope of the facility, such as gravity flow sewers, will require a detail drawing of the new facility. The drawing must show the elevation of the new facility in relation to the elevation of the existing TransCanada pipeline(s) with the clearances identified.

9. Bored crossings are an acceptable method for constructing a crossing of a TransCanada pipeline(s) for cables, pipes, drains, etc. provided the following conditions are met:

- A drawing detailing the proposed bored crossing must be submitted to TransCanada for review and approval prior to construction. The items to be included on the drawing include; location of bore pits, alignment of the new facility, location of existing underground facilities, elevation profiles, etc.
- The top and side (side closest to the drill) of all TransCanada pipelines or buried facilities must be exposed by hand digging or hydrovac.
- Sight holes must be excavated at a minimum of five feet and a maximum of ten feet from the side (nearest to the drill) of each buried facility, and parallel to the existing TransCanada buried facility.
- Any bore pits required to set up and stage equipment shall be outside of TransCanada's buried facility right-of-way.
- The new crossing facility should maintain a continuous depth or consistent profile and straight horizontal alignment across the full width of the TransCanada right-of-way.
- The crossing facility must pass the TransCanada facility with a minimum clearance of three feet.

10. When existing TransCanada buried pipelines are exposed, resulting in an unsupported length of 5 times the diameter of the existing pipeline, as a minimum, the following requirements shall be met:

- A layer of select bedding material, sand or a mixture of sand and crushed stone, shall be placed on the bottom of the trench 2 feet wider than the pipeline. This bedding shall be a minimum of 4 inches thick and be compacted.
- Structural backfill sand shall then be carefully placed in 6 inch lifts and compacted up to the middle of the TransCanada pipeline.
- The backfill, sand or native soil, above the pipe shall be free of rocks, cobbles and boulders and be compacted enough to prevent excessive settlement.

11. Underground electrical cables must be installed crossing the entire width of the TransCanada right-of-way using heavy wall conduit or PVC conduit to protect against the possibility of damage or electric shock from probing.

12. Underground cables energized to 600 volts or more should cross a minimum of 3 feet (1m) below the pipeline if practical, be encased in concrete, color coded red, across the entire right-of-way width, and have external, spiral wound, neutrals grounded on each side of the right-of-way. The cable crossing should be clearly and permanently marked on each side of the right-of-way, if practical.

13. The design of overhead electrical cables energized to 600 volts or more that cross or parallel within 200 feet of TransCanada's pipeline(s) must be reviewed and approved by TransCanada. This review may require installation of induced AC mitigation facilities, additional aerial markers, increased clearance to conductors, etc.

14. Blasting activities within 500 feet of the TransCanada right-of-way shall not occur until the blasting plan is reviewed and approved by TransCanada. This blasting plan is to be submitted to TransCanada for review a minimum of two (2) weeks prior to blasting activities.

15. Dredging activities within 500 feet of the TransCanada right-of-way shall comply with the following minimum requirements:

- A TransCanada representative must meet with the Corps of engineers representative to review the plan.
- TransCanada must be contacted at least 72 hours prior to coming within 500 feet of the pipeline.
- A TransCanada representative must be on board the vessel when the dredging operation is within 500 feet of the pipeline.
- The TransCanada representative shall ensure the safety of the pipeline by stopping work if an unsafe condition exists.

16. In the event of equipment crossings outside of an existing road right-of-way or wherever our technician determines that inadequate cover exists, the contractor shall install and maintain temporary crossings of TransCanada's pipeline(s) at location(s) specified by TransCanada and that are/is perpendicular to TransCanada's pipeline(s). A minimum of five (5) feet of total cover over TransCanada's pipeline(s) is required. If fill is required to obtain the minimum cover, a suitable material (preferably a bank run gravel material, or a combination of wooden mats and bank run gravel, or a TransCanada approved "Portable Land Bridge") will be placed on the existing surface of the ground over the pipeline(s) from a point fifteen (15) feet ahead of the pipeline crossing to a point fifteen (15) feet beyond the pipeline crossing. The crossing area should be a minimum of twenty (20) feet wide so as to adequately bear the crossing weights of equipment. All vehicular traffic will cross TransCanada's pipeline(s) at these designated locations only.

17. The applicable state one-call system must be contacted at 811 in accordance with its advance notification requirements prior to any ground disturbance.

18. If you will be crossing one or more of TransCanada's transmission pipeline(s) please be aware that these pipeline(s) are coated with a material to protect them from corrosion. The coating may contain asbestos. If the excavation results in exposing TransCanada's pipeline(s) and there is any damage to the coating, you will be responsible for all costs, including any disposal costs, associated with the coating repair. If necessary, you will also be required, to halt its work activity while the coating material is being analyzed. The coating repair, including the removal of the original material, will be performed by TransCanada personnel or a qualified third party contractor selected by TransCanada. All work will be done in accordance with TransCanada's current engineering and environmental standards. During the course of the excavation work, Contractor agrees to cooperate with TransCanada to insure all federal, state and local environmental and safety regulations are followed.

19. Should it be necessary for a TransCanada employee/representative to enter the excavation to inspect its pipeline(s), the excavation at the crossing shall be sloped in accordance with the requirements of the Occupational Safety and Health Administration.

TransCanada looks forward to working with you to minimize impact resulting from your project and also provide for the safety of the general public and the integrity of our pipelines. Should you have any further questions in regard to these guidelines please contact me at 248-205-7408.

Plans may be submitted to:

Crossings and Encroachment Applications
us_crossings@transcanada.com

U.S. Land Management
5250 Corporate Drive
Troy, Michigan 48098

TOP Contact: Aprameya Ambalae

Instructions:

1. This form is to be completed in conjunction with Pipeline Crossing and Encroachment Procedure (EDMS No. 003858625) and Pipeline Crossing and Encroachment Procedure (Canada) (EDMS No. 003674617).
2. Save this form using the following naming convention (steps 2 is only required if you are filing the form electronically).
   - **Forms associated with Procedures**: **Procedure Title_Avantis Facility ID_Work Order #.doc** (e.g. Heavy Equipment Crossing_00003_12345.doc)
   - Attach the completed form to the Avantis Work Order (if/where applicable), please refer to the 'Attaching Documents to Work Orders' website and user guide.
3. For information on filing and the onsite/offsite retention requirements, please refer to the 'Facility Filing Structure Reference' compliance list (EDMS No. 003794696).
4. Please complete form and send/fax to Regional Land Manager or in Canada – TransCanada Land Department.

ATTENTION REQUESTING COMPANY:
Please complete yellow hi-lited sections only.

Crossing Information (To be completed by on-site technician)	
Requesting Company /Stakeholder:	Ph.: ( )
Stakeholder Type: **Landowner,** **Contractor,** **Utility,** **Developer,** **Other** (describe)	
Notified How? **One Call,** **Contacted by Landowner,** **Aerial Patrol,** **Other** (describe)	
Legal Location / Milepost / MLV / GPS Location:	
Affected Line Number(s):	
Units of Measurement: **Imperial(e.g. lbs / ft),** **Metric (e.g. kg / m),** **Other** (describe)	
TCPL Drawing # (if applicable):	
Permanent Crossing - Date Required:	
Temporary Crossing - Approx. Date / Duration:	

Pipeline Information (To be completed by on-site technician)				
	Line 1	**Line 2**	**Line 3**	**Line 4**
Pipeline OD (in)				
Pipeline Wall Thickness (in mm)				
Pipeline SMYS or Grade (psi kPa)				
Class Location				
MAOP of Pipeline Segment (psi kPa)				
Existing Depth of Cover (in m)				
Note: If more than four pipelines are being crossed with different attributes please complete this section for the additional lines and attach multiple copies to heavy equipment form.				

Soils Information (To be completed by on-site technician, consult engineering if unsure of category)	
Soil Type (Select one)	Granular Materials without cohesion (dry sand) / Sand and Gravel / Saturated Topsoil / Clay / Saturated Clay / Other (describe):
Soil Saturation Level (Select One)	Wet / Dry / Normally Dry / Normally Wet / Transitional Area Dry to Wet / Other (describe):
Crossing Type (Select One)	Asphalt / Concrete / Timber Mats / No pavement / Other (describe):
Construction Type if known (Select One)	Open Cut / Bored Crossing / Open cut-rock / Other (describe):

Please complete the following tables for the heaviest vehicle in each category (It is recommended that this section be completed by the encroaching party).

TIRED VEHICLES - Permanent Access Vehicles

Total Vehicle Weight:

lbs

kg

Axle Groupings	**Weight per Axle Group (lbs kg)**
Single	
Tandem (8 Wheel)	
Tandem (16 Wheel)	
Tridem	
Other (specify):	

TIRED VEHICLES - Temporary Access Vehicles

Total Vehicle Weight:

lbs

kg

Axle Groupings	**Weight per Axle Group (lbs kg)**
Single	
Tandem (8 Wheel)	
Tandem (16 Wheel)	
Tridem	
Other (specify):	

TRACKED VEHICLES

Max Vehicle Weight (lbs kg)	**Make**	**Model**	**Track Length (ft m)**	**Track Shoe (ft m)**

Please include an explanation or diagram or photos of the crossing equipment using the space provided:

BP GENERAL CONSTRUCTION REQUIREMENTS

1. Contact BP's local Field Representative to arrange an onsite meeting with your surveyor to determine the location and depth (locates) of BP's pipeline(s) within the scope of, or in close proximity**,** to your project. The location and depth of BP's pipeline(s) must be incorporated into your design plans. The contact information for BP's local Field Representative will be provided by the Right-of-Way Agent assigned to assist you with your request.

2. BP's local Field Representative will consider site conditions, the pipeline(s) location and other factors to determine the number of, and distance between the individual locates, at a minimum:

    a. The pipeline(s) shall be located at each proposed road, or utility crossing, drainage channel or ditch, areas of proposed grade change within the pipeline right-of-way and proposed equipment crossing locations.

    b. Additional location data may be required as your design plans are reviewed or revised. The same procedures apply to all subsequent locate requests.

3. Using the location data, accurately depict BP's pipeline(s) on your design plans. The following information should also be included on your plans even if there are no temporary or permanent structures proposed in the pipeline right-of-way:

    a. BP's pipeline(s) shall be indicated on all applicable plan sheets by pipe diameter and labeled, "BP High Pressure Petroleum Pipeline".

    b. Indicate the proposed location(s) where construction equipment will cross the pipeline and the method of preventing crossing for the remaining pipeline right-of-way within the project limits.

4. Proposed improvements that involve grade changes, new structures or changes to any existing structures in, on, under, over, above or along BP's right-of-way require a separate plan and profile drawing of BP's pipeline(s) clearly indicating the existing and the proposed conditions and:

    a. Include sub-grade detail indicating all materials and the thickness of each layer/course.

    b. Indicate the amount of existing cover that will be removed from the pipeline(s). Note: Method and specific equipment list must be included.

    c. Indicate the amount of cover that will be added over the pipeline(s) and right of way. Note: Method and specific equipment list must be included.

    d. Indicate the location and distance of any stock/soil piles to BP's pipeline(s).

e. Show the clearances between BP's pipeline(s) and any existing and new buried or overhead utilities that cross the pipeline right-of-way.

f. Show the clearances between BP's pipeline(s) and each proposed substructure.

g. Utilities to be installed via boring, drilling, or tunneling require procedure details included on your design plans. Note: "Blind" boring is not permitted.

h. Indicate any areas of disturbance or other work that will require BP's pipeline(s) to be exposed in order to perform your work.

i. Any additional requests required by BP Engineering to complete assessment.

5. If the existing drainage pattern within the project scope will be impacted or altered in any way, submit a drainage plan that specifically identifies new flow paths and all inlet/outfall/collection points.

6. Redline all BP facilities on submitted drawings or include all page numbers where BP facilities appear on submitted drawings on 'Design Plans Submission Checklist.

7. Include/incorporate 'BP's Right-of-Way Use Requirements' as a part of your final design plans. The Requirements will be provided to you by BP's Engineering and Right of Way group after review of your pre-final plans. Include BP on the Utilities List and include BP's Field Representative's name and phone number on the plans.

Complete the following 'Design Plans Submission Checklist' and 'Equipment Inventory List' and include both with your design plans submittal. Mail two full sized sets of design plans to;

BP Pipelines (North America) Inc.
ROW Department - Bldg 600
150 West Naperville Road
Naperville, IL 60563

Or a digital copy to the Right-of-Way Agent assigned to your request.

Design Plans Submission Checklist

Yellow shaded information required when submitting plans for initial Engineering review.

Project Name	

PROPERTY OWNER'S INFORMATION	
Property – Legal Owner / Entity	
Property Address or Legal Description	
Owner Contact Name	
Contact Address	
Phone Number(s) *office / cell*	
Contact Email	

DESIGN ENGINEERING COMPANY INFORMATION	
Design Engineering Company	
Address	
Design Engineer's Name	
Phone Number(s) *office / cell*	
Design Engineer's Email	

DEVELOPER'S INFORMATION	
Developer's Legal Name	
Address	
Phone Number(s) *office / cell*	
Project Manager's Name	
Phone Number(s) *office / cell*	

PROJECT LOCATION				
County	**State**	**Section(s)**	**Township**	**Range**

PROJECT TIME LINE	
Anticipated Bid Date:	
Anticipated Construction Start Date:	

THE ABOVE REFERENCED PROJECT INVOLVES THE FOLLOWING WHICH MAY IMPACT BP'S RIGHT-OF-WAY OR FACILITIES:

CHECK ALL THAT APPLY:

	Cover, grading, elevation or drainage pattern changes
	Aboveground or underground structures (including fences)
	Landscaping within 25 feet of the centerline of BP's pipeline(s)
	Road, driveway, sidewalk, bike path, or parking areas
	Underground or overhead utility crossings
	Fiber-optic, communications or street/traffic control lights
	Farming and agricultural related facilities
	Temporary access roads or construction equipment crossings
	Boring, drilling or tunneling
	Blasting, seismic vibration or construction induced vibration
	Exposure of BP's pipeline(s)
	BP facilities redlined on included drawings
	Page list for BP facilities on included drawings (any omission will delay assessment)
	Other – explain below

OTHER	

EQUIPMENT INVENTORY LIST

MAKE	MODEL	NO. of AXLES	TRACK Width x Length of track on ground	FULLY LOADED WEIGHT

Signed: _____

Name: _____
Please Print

Title: _____ Email Address: _____

bp

BP Pipelines (North America), Inc.
150 W. Warrenville Road
Naperville, IL 60563

BP PIPELINES (NORTH AMERICA) INC.
GENERAL CONSTRUCTION REQUIREMENTS

ROW File Reference: 9019

BP Pipelines (North America) Inc. (hereinafter referred to as "BP") is committed to environmental stewardship and maintaining the safety of its employees, contractors and the general public. The pipelines BP operates transport various liquids and gasses at high pressure, and do so very safely each and every day. There are, however, potential hazards associated with construction or excavation work around pipelines. As a result of these potential hazards, and in compliance with the requirements imposed upon BP as an industry regulated by the U.S. Department of Transportation and Office of Pipeline Safety, the following list of general requirements for working on pipeline rights-of-way has been compiled.

Compliance with BP's General Construction Requirements does not guarantee BP's final approval of your project. These are considered guidelines. Each request will be assessed on a case by case basis and additional requirements specific to your project may apply.

General Safety Requirements

- **811 the national One-Call number, must be contacted at least 48 hours (2 working days)* before any construction and/or excavation activities are initiated within the pipeline right-of-way so that BP may have a representative present to ensure that there are no conflicts with the pipeline. (There is no cost to the third party contractor to use the One-Call Notification service. However, failure to utilize the One-Call service can be quite costly in terms of unnecessary risk for the contractor/excavator, their employees, innocent bystanders, personal property of others and the environment; as well as potential civil penalties and/or fines.)**

- **To have the pipeline physically located and depth verified, please contact BP's local field representative at Jeff Payne 219-313-6030**

- **It is the responsibility of the requestor to have the pipeline location and depth added to their plans and drawings and submitted to BP for evaluation.**

- **The requestor and/or its' contractor is responsible for taking all necessary safety precautions and will be held responsible for any damages caused to the pipeline or property as a result of their work.**

Michigan and Tennessee require 72 hours (3 working days) prior notice

Each proposed project or development in close proximity to the pipeline is of great concern to BP due to potential impact to the operation and integrity of BP's pipelines. To avoid costly and lengthy delays, plans should be submitted to BP during the early planning stages of the project. By working with Owner/Developers, BP strives to ensure the safety of the pipeline while supporting opportunities for property development.

Subdivision Planning

- BP requests all residential and/or commercial lot lines not be placed on the right-of-way. In cases where it is not possible to locate said lot lines off of the right-of-way, lot lines shall under no circumstances be placed on the pipeline.

Excavation Specific Requirements

- No excavation or construction activity will be permitted in the vicinity of a pipeline until all appropriate communications have been made with BP's field operations and the Right-of-Way Department. A formal engineering assessment may be required.

- There shall be no excavation or backfilling within the pipeline right-of-way for any reason without a representative of BP on site giving permission.

- In some instances, excavation and other construction activities around certain pipelines can be conducted safely only when the pipeline operating pressure has been reduced. Contractors are therefore cautioned that excavation which exposes or significantly reduces the cover over a pipeline may have to be delayed until the reduced operating pressures are achieved.

General Construction Activities

- The contractor shall not be permitted to transport construction materials or equipment longitudinally over the pipeline.

- Where it is necessary for construction equipment (*i.e.*, tractors, backhoes, dump trucks, etc.) or equipment transporting construction materials to cross the pipeline, the crossing of the pipeline right-of-way shall be at, or as near to, a 90˚ angle as is feasible.

- To gain access to the job site, the contractor shall submit a plan indicating where construction equipment will cross the pipeline, along with the depth of the pipe at the crossings, any proposed ramping over the pipeline, together with the following specifications for the equipment: type and weight of equipment; for track equipment – track width and length; for wheeled equipment – number of axles (single or tandem axles). BP will perform a stress factor calculation to determine if the equipment can safely cross the pipeline. If crossing of the pipeline is allowed, special measures may need to be taken to ensure the integrity of the pipeline.

- No track type construction equipment shall be permitted to pivot or turn directly over the top of the pipeline.

- A scraper or pan type tractor shall not be used for removal of soil within ten feet (10') of the centerline of the pipeline. Rubber tire or small track type equipment is an acceptable alternative.

- A sheepsfoot roller shall not be used for compaction purposes within five feet (5') or directly above the centerline of the pipeline.

- No vibratory rollers shall be used within three feet (3') of the centerline of the pipeline until the compacted cover over the pipeline has reached a depth of three and one-half feet (3 ½').

Parking Lots, Roads, Driveways, Fences and Structures

- No permanent structures may be constructed on the pipeline right-of-way (permanent structures shall include, but not be limited to, swimming pools, sheds, fences, earthen berms, bike paths, etc.).

- All permanent structures shall cross the pipeline right-of-way at, or as near to, a 90˚ angle as is feasible. In no instance shall the angle of the crossing be less than 45˚.
- There shall be a minimum vertical separation of two feet (2') between the pipeline and any underground structure.

- For proposed road crossings and driveways BP will perform a stress factor calculation to determine the amount of cover required over the pipeline. Under no circumstances shall cover be less than the following: a) five and one half feet (5.5') for all road crossings and commercial driveways, and b) three feet (3') for residential driveways.

- Proposals for parking lot construction on the pipe line right-of-way are discouraged.

- A minimum of four feet (4') of cover is required for all drainage ditches.

- No utility structures (such as, but not limited to, manholes or catch basins) shall be located over the pipeline. A minimum horizontal clearance of five feet (5') is required between the structure and the pipeline.

Landscape and Vegetation

- No trees are allowed on the pipeline right-of-way. BP may permit the installation of limited landscaping and minor shrubbery plantings with written communication and/or documentation. For a major development, landscaping plans must first be submitted in writing to BP for review and approval. Any plantings that restrict efficient aerial inspection or limit access to the easement area will be considered an interference and will not be allowed.

Foreign Line or Utility Crossings

- All foreign lines shall cross the pipeline right-of-way at, or as near to, a 90˚ angle as is feasible. In no instance shall the angle of the crossing be less than 45˚.

- In no instance shall the foreign line be placed parallel to the pipelines right-of-way.

- The foreign line shall cross under the pipeline with at least two feet (2') of vertical separation unless the pipeline is at a prohibitive depth. If the pipeline is at a prohibitive depth, BP personnel will review and evaluate the proposed crossing location to determine if it will be feasible to allow the foreign line to cross above the pipeline.

- If the foreign line is a telecommunications cable, power cable, or similar in nature, the foreign line shall be placed in a Schedule 40 PVC conduit, or greater, for a linear distance extending ten feet (10') on either side of the centerline of the pipeline. The entire length of carrier pipe shall either be encased in concrete, or shall have a concrete cap placed on top of it.

- If the foreign line is a metallic pipeline, or similar in nature, the foreign line shall be coated with a suitable coating for a distance of at least fifty feet (50') on either side of the centerline of the pipeline. The foreign line owner, operator, or their contractor, shall install cathodic protection bonds and potential test leads to the foreign line at the crossing location and terminate the leads at an above-ground location as identified by BP's on-site representative. BP will install the test leads on BP's pipeline.

- Below-ground precautionary flagging (warning tape) shall be placed in the ditch line above the foreign line. The warning tape shall be placed approximately one foot (1') below the final surface grade/elevation. The warning tape shall extend for a linear distance of ten feet (10') on either side of the centerline of the pipeline.

If, in the exercise of the pipeline easement rights, any "Permitted Facility" is damaged, disturbed or otherwise interfered with, BP and/or the pipeline easement owner shall be held harmless from and against any and all claims of whatsoever kind and nature which might be associated with or derived from such damage, disturbance or interference.

BUCKEYE REQUIREMENTS

BUCKEYE PARTNERS, L.P. AND AFFILIATES
Five TEK Park, 9999 Hamilton Boulevard
Breinigsville, PA 18031

Right-of-Way Use Restrictions Specification
Revision 4

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Purpose and Scope

This Right-of-Way Use Restrictions Specification (hereinafter called "Specification") has been developed by Buckeye Partners, L.P. and Affiliates (hereinafter called "Buckeye") and is intended for landowners, utility owners, general contractors and their sub-contractors, pipeline/utility contractors, real estate developers, brokers and agents, lending officers and title underwriters, engineers, architects, surveyors, and local / governmental elected staffs (hereinafter called "Crossing Party") as a guideline for the design and construction of proposed land development.

Buckeye appreciates this opportunity to work with you in the planning stages of your development (or construction activity), and we look forward to working with you proactively. Buckeye's primary concern when activities are taking place near our pipeline is public safety and environmental protection. The intent of this Specification is to provide a clear and consistent set of requirements that will: (1) reduce the risk of damage to our pipeline and related facilities; (2) ensure unencumbered access to our right-of-way and pipeline facilities and the availability of adequate workspace for routine maintenance, future inspection, and/or repair work on our pipeline; and (3) enable the effective corrosion protection of our pipeline.

All such activities and projects that are performed near Buckeye's pipeline facilities are subject to formal review by Buckeye prior to issuance of final written approval. Depending on the scope of the project and its impact on Buckeye's pipeline facilities, additional engineering requirements and protective measures may apply. The following requirements are not only the policy of Buckeye, but comply with regulations set forth by the United States Department of Transportation, Safety Regulations, 49 CFR, Parts 192 and 195.

We want to be a good neighbor, but to do so requires us to act responsibly in protecting our right-of-way and preventing damage to the pipeline system. While we want to make every effort to accommodate your desired use of your property, our responsibility for public safety is paramount. Through proper planning and communications, we can ensure the safety and integrity of our pipeline system and the welfare of our neighbors.

The transmittal of this Specification does not constitute Buckeye's approval or permission for the Crossing Party to begin construction or work within or across the pipeline right-of-way. Work may not commence until written authorization approving such work has been issued by Buckeye.

1.0 General Guidelines

1.1 The safety of the pipeline must be considered at all times. No attempt to probe for or engage in any construction activities which might damage the pipeline is permitted.

1.2 Before any preliminary field work or construction begins in the vicinity of Buckeye's pipeline, a determination of the exact location and elevation of the pipeline must be made. To coordinate this procedure, please contact our local Field Operations Manager at the Buckeye facility nearest to your proposed project (see Attachment 1 for a listing of Buckeye's facilities and telephone numbers).

1.3 All proposed drawings/plans must be submitted to Buckeye's Right of Way Department for review to determine to what extent, if any, the pipeline or right-of-way will be affected by the proposed construction and/or development. These drawings/plans must be prepared in strict compliance to Attachment 4, "Requirements for Submission of Design Plans".

1.4 When any construction activity is conducted in or around our pipeline right-of-way, Buckeye's On-Site Inspector must be present at all times. **NO WORK SHALL TAKE PLACE WITHOUT A BUCKEYE ON-SITE INSPECTOR PRESENT**. For this free-of-charge service, contact our local Field Operations Manager at the Buckeye facility nearest to your proposed project.

1.5 The Crossing Party shall contact Buckeye for re-marking of a pipeline if the existing markers are inadequate for any reason, including disturbance due to construction activities.

Note: Federal law prohibits the removal of pipeline markers.

1.6 The Crossing Party shall not burn trash, brush, or other items or substances within 50 feet of the pipeline.

1.7 The Crossing Party shall not store any equipment or materials on the right-of-way.

1.8 During routine or emergency maintenance on the pipeline, the cost to restore approved surface improvements (e.g., pavement, landscaping, sidewalks, etc.) shall be the responsibility of the Crossing Party.

2.0 Excavation and Construction Restrictions

2.1 Excavation operations shall be performed in accordance with appropriate State "One-Call" utility locating system requirements. As a matter of State law, anyone undertaking excavation work is required to call three (3) working days before excavating in MA, ME, MI, MO, NJ, PA, SC, TN, and WI; two (2) working days in all other states (see Attachment 3 for State "One-Call" numbers).

2.2 The Crossing Party will conduct "white-lining" of any proposed excavation areas. Buckeye will erect temporary pipeline markers/flags (yellow) identifying the location of the pipeline within the work area, and will provide information on how to respond should the pipeline be damaged or a commodity release occur. All personnel operating equipment over or around the pipeline must be made aware of its location and what to do if they make contact with the pipeline.

2.3 When a Crossing Party excavates near Buckeye's pipeline, a Buckeye representative must locate the pipeline and determine the depth of cover before the Crossing Party begins excavation. The Buckeye representative and the excavator must review and complete an Excavation Safety Checklist (Attachment 8). The Crossing Party shall not perform any excavation, crossing, backfilling, or construction operations until Buckeye's On-Site Inspector has reviewed the proposed work on site and given approval for work to proceed. Buckeye's On-Site Inspector shall have full authority to stop the work if it is determined that the work is being performed in an unsafe manner.

2.4 No equipment shall work directly over the pipeline. The Crossing Party shall install temporary fencing along Buckeye's right-of-way boundaries so that equipment will not inadvertently pass over the pipeline at locations other than those established for crossing (see Section 3.6).

2.5 When excavating within the right-of-way, the Crossing Party's backhoe shall have a plate welded over the teeth of the backhoe bucket, and the side cutters must be removed prior to

excavation. However, if within 24 inches of the outer edge of the pipe (this "tolerance zone" extends on all sides of the pipe), only hand excavation, air cutting, and vacuum excavation are permitted.

2.6 No excavations shall be made on land adjacent to the pipeline that will in any way impair, withdraw lateral support, cause subsidence, create the accumulation of water, or cause damage to the pipeline or right-of-way.

2.7 The Crossing Party shall ensure all excavation work complies with OSHA's excavation standards outlined in 29 CFR 1926 and correct any noncompliant excavation site before Buckeye's On-Site Inspector or the Crossing Party enters the site to perform work.

2.8 If conditions require, the Crossing Party shall be directed by Buckeye to install sand or cement bags or other suitable insulating materials to maintain proper vertical clearance from the pipeline.

2.9 At any location where the pipeline is exposed, the Crossing Party shall provide Buckeye the opportunity to inspect the pipeline condition, install cathodic protection test leads, and/or install underground warning mesh.

2.10 The maximum unsupported exposed length of pipe shall be 20 feet for 4-inch-diameter pipe, 25 feet for 6-inch- to 10-inch-diameter pipe, and 35 feet for 12-inch- to 24-inch-diameter pipe. When required, the pipeline shall be supported with grout and sand bags or padded skids. At no time shall the pipeline be used as a brace to support equipment or sheeting/shoring materials.

Note: The Crossing Party shall submit a support plan for Buckeye's review and approval.

2.11 No buried pipeline may be left exposed for any duration of time without concurrence of Buckeye's On-Site Inspector.

2.12 Backfill and compaction shall be performed to the satisfaction and in the presence of Buckeye's On-Site Inspector. At least 6 inches of fine, loose earth or sand with no sharp gravel, rock, hard clods, vegetation, or other debris shall be placed on all sides of any pipeline, and remaining backfill shall be placed so as not to disturb this padding material or damage the pipeline. Backfill over the pipe shall be compacted by hand until 18 inches of cover is achieved. The disturbed ground shall be compacted to the same degree of compaction of surrounding areas. The Crossing Party shall restore the site to its original condition except for items that are part of the Buckeye approved change.

3.0 Specific Guidelines

3.1 Cover, Grading, and Drainage

3.1.1 **Cover and Grading**:

a. The existing cover over the pipeline shall not be modified without Buckeye's written approval.
b. The final grading shall net a minimum cover of 36 inches over the pipeline.
c. In areas where buildings are proposed within 50 feet of the pipeline or due to other surface improvements and/or in areas determined by Buckeye, final grading shall net a minimum cover of 48 inches over the pipeline.
d. The maximum allowable cover/soil shall not exceed six (6) feet without Buckeye's written approval.

e. Use of vibratory equipment larger than walk-behind units is not permitted within 25 feet of the pipeline.

3.1.2 **Drainage**:

a. Detention ponds, lakes, structures or any type of impoundment of water, temporary or permanent, are prohibited within the right-of-way.
b. Culverts are not permitted within the right-of-way.
c. Any modifications to an existing drainage pattern shall be designed such that the erosion of the pipeline cover is controlled.
d. For streams, drainage channels, and ditches, a minimum of cover of 60 inches is required between the pipeline and the bottom of the drainage canal or ditch (see Section 3.3.1.f for road drainage ditches).

3.2 Aboveground and Underground Structures

3.2.1 **General Requirements**:

a. Buildings or other structures, including, but without limitation, overhanging balconies, patios, decks, swimming pools, wells, walls, septic systems, propane tanks, transformer pads, or the storage of materials which creates an obstruction or prevents the inspection of the right-of-way by air or foot, shall not be erected within the right-of-way.
b. The Crossing Party shall not develop or build retaining walls, drive piling or sheeting, or install an engineered structure that develops or controls overburden loads that will impact the pipeline (see Section 3.9).
c. Deep foundations which include piers, caissons, drilled shafts, bored piles, and cast-in-situ piles located within 500 feet of the pipeline shall be installed/drilled using an auger.
d. Occupied structures shall not be located within 50 feet of the pipeline unless a minimum cover of 48 inches is provided above the top of the pipeline.
e. Any deviation for aboveground and underground structures will be reviewed by Buckeye on a ***case-by-case basis***.

3.2.2 **Gardening and Landscaping**:

a. Trees or large shrubs and bushes are not permitted within the right-of-way. Trees planted outside of the right-of-way should be placed so branches and limbs will not overhang the pipeline right-of-way as the tree matures. Buckeye may trim/remove overhanging branches and limbs that encroach into the right-of-way.
b. Flowerbeds, vegetable gardens, lawns, and low shrubbery not exceeding 30 inches are permitted within the right-of-way. Buckeye is not responsible for replacing any plantings located within the right-of-way.

3.2.3 **Fences and Walls**:

a. Privacy fences or fences that prevent access to the right-of-way are not permitted.
b. All other fence installations within the right-of-way will be reviewed for approval by Buckeye on a ***case-by-case basis***. Upon Buckeye's written approval, fences shall be constructed with a 14-foot gate or removable sections across the right-of-way.
c. Fence posts shall not be installed within 5 feet of the pipeline and must be equidistant if crossing the pipeline.
d. No fence shall cross the right-of-way at less than a 60-degree angle.
e. Fences that run parallel to the pipeline shall be installed outside the right-of-way.
f. Masonry, brick, or stone walls are not permitted on the right-of-way.

3.3 Roads, Driveways, Sidewalks, and Parking Areas

3.3.1 **General Requirements**:

a. Roads, driveways, sidewalks, or parking areas shall not be constructed across the right-of-way without Buckeye's written approval. Upon Buckeye's approval, roads, driveways, and sidewalks shall cross perpendicular to the pipeline.
b. The maximum allowable cover shall not exceed six (6) feet without Buckeye's written approval.
c. Use of vibratory equipment larger than walk-behind units is not permitted within 25 feet of the pipeline.
d. Roads or driveways shall not be installed longitudinally within the right-of-way.
e. For roads and driveways, a minimum cover of 48 inches with a net cover of 36 inches of undisturbed soil is required above the pipeline.
f. A minimum cover of 36 inches over the pipeline is required at road drainage ditches. Upon Buckeye's approval, this cover can be reduced to 24 inches if ditch is rock/rip-rap lined and 12 inches if ditch is concrete lined.
g. For asphalt parking lots and sidewalks, a minimum cover of 36 inches with a net cover of 24 inches of undisturbed soil is required above the pipeline. Additional cover may be required by Buckeye based upon specific site conditions.

3.4 Foreign Utility Crossings

3.4.1 **General Requirements**:

a. Utilities shall cross perpendicular to the pipeline.
b. Utilities are required to cross beneath the pipeline with a minimum clearance of 24 inches. Exceptions to Buckeye's clearance requirements for underground service entrances to single family dwellings will be reviewed on a ***case-by-case basis***.
c. Sand or select fill shall be placed between the pipeline and utility (see Section 2.8).
d. Utilities installed parallel to the pipeline shall be reviewed by Buckeye on a ***case-by-case basis***. If approved, the utility shall be no closer than 15 feet from the pipeline.
e. Warning tape, in accordance with A.P.W.A. Uniform Color Code, shall be placed above utility, 12 inches below ground, for a distance of 25 feet on either side of crossing.
f. Signage shall be placed at crossing as determined appropriate by Buckeye.
g. Trenchless Excavations:
   [1] Utilities installed by a trenchless excavation method (directional drilling, jacking, slick boring, etc.) shall be reviewed by Buckeye on a ***case-by-case basis***.
   [2] Buckeye reserves the right to select the method of crossing for the proposed utility.
   [3] A minimum clearance of 60 inches (5 feet) below the pipeline is required.
   [4] For directional drilling operations, a surface wire tracking system is required to verify the exact location of the drill head.
   [5] A 4 feet by 4 feet excavation window, 24 inches below the pipeline is required for visual inspection of the pipeline to ensure the drill (or bore) does not impact the pipeline.
   [6] Blind boring is not permitted within Buckeye's right-of-way.

3.4.2 **Metallic Utilities**:

a. Bonds and test leads shall be installed at the expense of and by the Crossing Party where Buckeye deems necessary.
b. Utilities shall be coated with a non-conductive coating for a distance of 50 feet on either side of the pipeline crossing.

c. Ductile water pipe shall include nitrile gaskets within 50 feet of the pipeline crossing or anywhere within 25 feet of horizontal offset locations.

3.4.3 **Non-Metallic Utilities**:

a. Utilities shall be wrapped with tracer wire within the width of the right-of-way.
b. Natural gas (or other industrial gases) lines shall be encased in a 6-inch envelope of yellow 2,000 psi concrete across the right-of-way.
c. PVC water pipe shall include nitrile gaskets within 50 feet of the pipeline crossing or anywhere within 25 feet of horizontal offset locations.

3.5 Electrical, Fiber-Optic, and Communications Cables

3.5.1 **General Requirements**:

a. Cables shall cross perpendicular to the pipeline.
b. Cables installed parallel to the pipeline shall be reviewed by Buckeye on a ***case-by-case basis***. If approved, the cable shall be no closer than 15 feet from the pipeline.
c. Splice boxes, service risers, energized equipment, etc., are not permitted within the right-of-way.

3.5.2 **Buried Cables**:

a. Cables are required to cross beneath the pipeline with a minimum clearance of 24 inches. Exceptions to Buckeye's clearance requirements for underground service entrances to single family dwellings will be reviewed on a ***case-by-case basis***.
b. Sand or select fill shall be placed between the pipeline and cable (see Section 2.8).
c. All cables shall be installed in Schedule 80 PVC pipe and encased in a 6-inch envelope of red 2,000 psi concrete (orange for fiber) across the right-of-way.
d. Warning tape, in accordance with A.P.W.A. Uniform Color Code, shall be placed above the utility, 12 inches below ground, for a distance of 25 feet on either side of the crossing.
e. Signage for the crossing shall be placed as determined appropriate by Buckeye.
f. Trenchless Excavations:
   [1] Utilities installed by a trenchless excavation method (directional drilling, jacking, slick boring, etc.) shall be reviewed by Buckeye on a ***case-by-case basis***.
   [2] Buckeye reserves the right to select the method of crossing for the proposed utility.
   [3] A minimum clearance of 60 inches (5 feet) below the pipeline is required.
   [4] For directional drilling operations, a surface wire tracking system is required to verify the exact location of the drill head.
   [5] A 4 feet by 4 feet excavation window, 24 inches below the pipeline is required for visual inspection of the pipeline to ensure the drill (or bore) does not impact the pipeline.
   [6] Blind boring is not permitted within Buckeye's right-of-way.

3.5.3 **Aboveground Cables**:

a. A minimum of 20 feet of above-grade clearance for a distance of 25 feet on each side of the pipeline is required.
b. Mechanical supports and service drops including poles, towers, guy wires, ground rods, anchors, etc., are not permitted within 25 feet of the pipeline.

3.6 Temporary Access Roads and Heavy/Construction Vehicle Crossings

3.6.1 **General Requirements**:

a. Trucks carrying a maximum axle load up to 15,000 pounds may cross the right-of-way after Buckeye has confirmed a minimum cover of 48 inches over the pipeline.
b. For all other cases, earthen ramps (see Attachment 6), swamp mats, reinforced-concrete slabs (see Attachment 5), or steel plates may be required. Loading conditions and protection measures will be evaluated and dictated by Buckeye's Engineering Department.
c. During the use of an approved temporary construction road, Buckeye may require that the Crossing Party provide additional protective measures deemed necessary to prevent damage to the pipeline.
d. Buckeye will limit the number of temporary construction roads constructed by the Crossing Party.

3.7 Railroad Crossings

3.7.1 **General Requirements**:

a. A minimum clearance of 72 inches is required between railroad tracks and the pipeline.
b. A minimum cover of 36 inches is required between the bottom of drainage ditches on either side of a railroad and the pipeline.
c. For railroad main lines, the pipeline crossing must comply with local railroad guidelines that delineate the requirements for carrier pipe, casing pipe, and clearances. Buckeye shall be consulted for the review of any State submittals.
d. For private spur crossings, Buckeye will determine the railroad entity having jurisdictional authority to dictate crossing requirements.

3.8 Farming and Field Tile

3.8.1 **General Requirements**:

a. Field tile running parallel to the pipeline shall be spaced 10 feet from the centerline of the pipeline.
b. Field tile shall cross the pipeline perpendicularly with a clearance of 12 inches above or below the pipeline.
c. Buckeye will approve the total number of crossings of the pipeline on a ***case-by-case basis***.
d. Deep plowing or "ripping" operations shall be approved by and coordinated with Buckeye.

3.9 Construction-Induced Vibrations

3.9.1 **General Requirements**:

a. Construction activities that generate ground vibrations, including, but without limitation, pile driving, sheet driving, soil compaction work, jackhammering, or ramming, shall be reviewed by Buckeye on a ***case-by-case basis***.
b. If the Crossing Party anticipates such an activity within 300 feet of the pipeline, then continuous testing monitored by a seismograph located directly over the pipeline at its closest point to the activity must be conducted. The Crossing Party shall provide, at their expense, the monitoring service which must be approved by Buckeye.

c. The particle velocity of any one component of a three-component seismograph must not exceed 2.0 inches per second as recorded on the seismograph placed directly over the pipeline.

3.10 Blasting Operations

3.10.1 **Blasting within 500 feet of the pipeline right-of-way**:

a. The Crossing Party must submit a blast plan to Buckeye for review and approval. Verbal and written notice will be given 14 and 21 days respectively.
b. Blasting plans must include the following information:

- Dates blasting to occur
- Explosives type
- Maximum shot hole depth and diameter
- Number of holes and spacing
- Delay pattern
- Delay types and intervals
- Depth of overburden
- Depth of blast area
- Maximum charge per hole, per delay
- Show drilling/blasting pattern plan and profile in relation to Buckeye facilities
- Calculated radiant peak particle velocity (PPV) at varying distances from the pipeline and at the pipeline itself
- State permit (copy)
- Blasting contractor qualifications and insurance certificate (copy)
- Blasting Safety Plan (copy)

The Crossing Party shall complete Attachment 7, "Blasting Plan Submission Form", and include this form with their submission to Buckeye.

c. The Crossing Party shall make arrangements for a Buckeye On-site Inspector to be present to witness the blasting operation.

3.10.2 **Blasting within 300 feet of the pipeline right-of-way**:
(**Adds to or replaces items in Section 3.10.1**)

a. Blasting shall be monitored by a seismograph located directly over the pipeline at its closest point to the blast hole(s). The Crossing Party shall provide, at their expense, the monitoring service which must be approved by Buckeye.
b. The particle velocity of any one component of a three-component seismograph must not exceed 2.0 inches per second as recorded on the seismograph placed on the ground directly over the pipeline.
c. For blast testing, an initial test blast using a maximum charge of one pound shall be performed. The Crossing party shall detonate the first test blast with all necessary monitoring equipment in place to observe the results of the proposed blast design. Each subsequent test blast may be set and detonated only after the seismograph reading from the previous test blast indicates that further blasting can be safely conducted.
d. Routine production blasting may be initiated after completion of a successful test blast, with allowable charge based on the seismographic vibration recordings of test blasts. However, all blasting must be continuously monitored by a seismograph. The velocity recorded must not exceed the 2.0 inches per second limit noted above.

3.10.3 **Blasting within 50 feet of the pipeline right-of-way**:
(Adds to or replaces items in Section 3.10.2)

a. The Crossing Party shall hire a consulting firm that specializes in underground blasting to conduct the seismograph survey and certify the results.
b. Buckeye will approve the Crossing Party's selection of consulting firms that will conduct the seismographic surveys before starting any blasting operation.

3.10.4 **Special Requirements**:

a. For multiple-delay blasting, the Crossing Party shall begin the blasting sequence at the charge closest to the pipeline and progress away from the pipeline.
b. If seismographic readings above the limit stated in item 3.10.2.d of this section are recorded, the pipeline must be exposed and inspected for possible damage and/or product release. The Crossing Party conducting blasting operations is responsible for all expenses related to the exposure and any subsequent repairs necessitated by the operation.
c. At Buckeye's request, the Crossing Party shall install sheet piling, open trench channels, and/or matting to protect the pipeline during blasting operations.

3.11 Seismic Vibrating Operations

3.11.1 **Seismic vibrating within 500 feet of the pipeline right-of-way**:

a. The Crossing Party must submit a seismic vibrating plan to Buckeye for review and approval. Verbal and written notice will be given 14 and 21 days respectively.
b. Seismic vibrating plans, when using Vibroseis System Vibrators to radiate ground vibrations, must include information on soil conditions and depth of exploration, the anticipated number and type of vibrations, type and weight of vehicle, and peak force of equipment.
c. The peak force by vehicle weight shall not exceed 45,000 pounds.
d. The Crossing Party shall also make arrangements for a Buckeye On-Site Inspector to be present to witness the seismic vibrating operation.

3.11.2 **Seismic vibrating within 100 feet of the pipeline right-of-way**:

a. Vibration shall be monitored by a seismograph located directly over the pipeline at its closest point to the vibrator(s). The Crossing Party shall provide, at their expense, the monitoring service which must be approved by Buckeye.
b. The Crossing party shall determine and limit the maximum peak force allowed under continuous seismographic vibration monitoring such that the peak particle velocity will not exceed 2.0 inches per second.
c. Seismic vibration surveys shall not be conducted closer than 100 feet to the pipeline.

3.11.3 **Special Requirements**:

a. If seismographic readings above the limit stated in item 3.11.2.b of this section are recorded, the pipeline must be exposed and inspected for possible damage and/or product release. The Crossing Party conducting seismic vibrating operations is responsible for all expenses related to the exposure and any subsequent repairs necessitated by the operation.
b. At Buckeye's request, the Crossing Party shall install sheet piling and/or open trench channels to protect the pipeline during seismic vibrating operations.

3.12 Wind Turbines

3.12.1 **Setback Distance from Pipelines**

a. Wind turbine structures shall be set back from any Buckeye pipeline at least a distance equal to 110% of the structure height, which is defined as the height of the entire wind turbine system as measured from the bottom of the base to the highest vertical point of the system including the base and tower and the highest reach of the turbines or blades.
b. No facilities associated with a wind turbine installation project shall be permitted to be installed within the pipeline easement.
c. Warning lights shall be installed on all wind turbines that are located within 1,200 feet of any Buckeye pipeline.

3.12.2 **Construction Equipment and Crane Crossings**

a. All temporary access roads and heavy/construction vehicle crossings shall comply with Section 3.6 above.
b. Where cranes and other maintenance vehicles will need to cross Buckeye pipelines on a routine permanent basis for maintenance of the turbine(s), permanent crossing locations must be established, an encroachment agreement must signed by the landowner and facility owner, and permanent crossing protections must be installed to the satisfaction of Buckeye.
c. Construction materials or equipment shall not be transported longitudinally over Buckeye's pipelines.

4.0 Deviations and Exceptions

4.1 When and where special circumstances dictate, deviation from these requirements must be formally approved by Buckeye in writing prior to commencement of any excavation or other construction activity that may impact the pipeline. Any such deviations must be explained and documented and provided to Buckeye for review and approval.

5.0 Additional Information and Buckeye Contacts

5.1 Should you have any questions regarding pipeline rights-of-way or your specific easement, contact Buckeye's Right of Way Department at the applicable phone number listed in Attachment 2.

5.2 Should you have any questions regarding Buckeye's engineering requirements, contact Buckeye's Encroachment Design Reviewer at the phone number also listed in Attachment 2.

Attachment 1: Buckeye Facility Locations and Phone Numbers

Alabama	Birmingham	(205) 369-0179
	Montgomery	(334) 309-4710
California	Lodi	(209) 368-9277
	San Diego	(714) 269-9028
Connecticut & Massachusetts	Wethersfield	(860) 529-7781
	New Haven	(203) 469-3479
Florida	Port Everglades	(954) 522-8464
Georgia	Birmingham (AL)	(205) 369-0179
Illinois	Argo	(708) 259-1352
	Lemont (West Shore)	(708) 227-0962
	Mazon	(815) 448-2491
	Hartford	(618) 255-1102
Indiana	Hammond	(219) 989-8601
	Hammond (West Shore)	(708) 227-0962
	Huntington	(260) 356-5802
Iowa	Cedar Rapids	(708) 259-1352
	Council Bluffs	(712) 366-9461
	Des Moines	(515) 226-4017
	Ottumwa	(641) 684-6789
Louisiana	Liberty (TX)	(936) 336-5773
Maine	South Portland	(207) 767-2672
Michigan	Wayne	(734) 721-8834
Missouri	Milan	(660) 265-4045
	St. Louis	(618) 225-1102
	Sugar Creek	(916) 836-6000
	Burlington Junction	(660) 725-3386
Nevada	Reno	(760) 802-1535
New Jersey	Linden	(908) 374-5301
New York	Auburn	(315) 253-5395
	New York City	(718) 656-5746
North Carolina	Goldsboro	(919) 778-2712
Ohio	Lima	(419) 993-8025
	Mantua	(330) 274-2234
	Toledo	(419) 698-8190
Pennsylvania	Boothwyn	(610) 459-3441
	Coraopolis	(412) 264-7432
	Duncansville	(814) 695-4852
	Malvern	(610) 695-8000
	Mechanicsburg	(717) 766-7633
	Macungie	(484) 232-4218
Tennessee	Memphis	(901) 395-0122
Texas	Liberty	(936) 336-5773
Wisconsin	Milwaukee (West Shore)	(708) 227-0962
	Madison (West Shore)	(815) 964-3727

Attachment 2: Right of Way & Engineering Contacts

Name	Responsibility	Phone / Address / Email
David Boone	**Manager, Right of Way, Permits & One Call**	(610) 904-4401 5 TEK Park, 9999 Hamilton Blvd. Breinigsville, PA 18031 DBoone@buckeye.com
Chris McPike	**Sr. Specialist, Right of Way** *Central District:* Eastern Ohio, Pennsylvania (Central & Western)	(412) 299-7019 469 Moon Clinton Road Coraopolis, PA 15108 CMcPike@buckeye.com
Marty White	**Sr. Specialist, Right of Way** *West/Central District:* Michigan, Ohio (except for Eastern Ohio), Indiana (except for Northwestern Indiana)	(419) 993-8008 940 Buckeye Road Lima, OH 45804 MWhite@buckeye.com
Michael Norris	**Sr. Specialist, Right of Way** *West District:* Northern & Central Illinois, Northwestern Indiana, Wisconsin	(219) 313-5321 12920 Bell Road Lemont, IL 60439 MRNorris@buckeye.com
Wesley Pekarek	**Specialist, Right of Way** *West District:* Iowa, Missouri, Southern Illinois	(816) 836-6096 1315 N. Sterling Ave. Sugar Creek, MO 64054 WPekarek@buckeye.com
Ronald Bates	**Sr. Specialist, Right of Way** *East/Northeast District:* Northeastern Pennsylvania, New York, New Jersey, Connecticut, Maine, Massachusetts, Maryland	(484) 232-4482 5002 Buckeye Road Emmaus, PA 18049 RBates@buckeye.com
Daniel Mangum	**Sr. Specialist, Right of Way & Development** *South District:* Texas, Louisiana, Tennessee, Alabama, Georgia, South Carolina, Nevada, Florida, North Carolina	(832) 325-1626 One Greenway Plaza, Suite 600 Houston, Texas 77046 DMangum@buckeye.com
Beth Auman	**Sr. Specialist, Right of Way** *Encroachment Design Review:* East, Northeast, Central, West Districts *East District:* Southeastern Pennsylvania, Virginia	(610) 904-4409 5 TEK Park, 9999 Hamilton Blvd. Breinigsville, PA 18031 Bauman@buckeye.com
Teriann Williams **Jeannette Fluke**	**Right of Way Coordinators** *Easements and Records:* Supporting East, Northeast, Central, and West Districts	(610) 904-4418 (610) 904-4404 5 TEK Park, 9999 Hamilton Blvd. Breinigsville, PA 18031 TEWilliams@buckeye.com JFluke@buckeye.com

Attachment 3: State One Call Systems (National One Call System - Dial 811)

State	One Call Program	Phone No.	Website
Alabama	Alabama 811	(800) 292-8525	www.al811.com
California - North **- South**	USA North of Central / Northern California & Nevada Dig Alert & Underground Service Alert South	(800) 227-2600 (800) 422-4133	www.usanorth.org www.digalert.org
Connecticut	Call Before You Dig	(800) 922-4455	www.cbyd.com
Florida	Sunshine State One Call	(800) 432-4770	www.callsunshine.com
Georgia	Georgia 811	(800) 282-7411	www.georgia811.com
Illinois - Non-Chicago **- Chicago**	Julie, Inc. DIGGER - Chicago Utility Alert Network	(800) 892-0123 (312) 744-7000	www.illinois1call.com www.cityofchicago.org/transportation
Indiana	Indiana 811	(800) 382-5544	www.indiana811.org
Iowa	Iowa One Call	(800) 292-8989	www.iowaonecall.com
Louisiana	Louisiana One Call System, Inc.	(800) 272-3020	www.laonecall.com
Maine	Dig Safe System Inc.	(888) 344-7233	www.digsafe.com
Massachusetts	Dig Safe System Inc.	(888) 344-7233	www.digsafe.com
Michigan	MISS Dig System, Inc.	(800) 482-7171	www.missdig.net
Missouri	Missouri One Call System, Inc.	(800) 344-7483	www.mo1call.com
Nevada	USA North of Central / Northern California & Nevada	(800) 227-2600	www.usanorth.org
New Jersey	New Jersey One Call	(800) 272-1000	www.nj1-call.org
New York	Dig Safely New York	(800) 962-7962	www.digsafelynewyork.com
New York City & Long Island	New York 811, Inc.	(800) 272-4480	www.newyork-811.com
North Carolina	North Carolina 811	(800) 632-4949	www.nc811.org
Ohio	Ohio Utilities Protection Service	(800) 362-2764	www.oups.org
Pennsylvania	Pennsylvania One Call System, Inc.	(800) 242-1776	www.pa1call.org
South Carolina	South Carolina 811 / PUPS	(888) 721-7877	www.sc811.com
Tennessee	Tennessee 811	(800) 351-1111	www.tnonecall.com OR www.tennessee811.com
Texas	Texas 811 OR Lone Star Notification Center	(800) 344-8377 (800) 669-8344	www.texas811.org www.lsnconecall.com
Wisconsin	Wisconsin Diggers Hotline	(800) 242-8511	www.diggershotline.com

811 Know what's below. Call before you dig.

PROJECT INFORMATION & LOCATION

BUCKEYE PARTNERS, L.P.

Project Title

Project Address | City | State | Zip Code

Latitude | Longitude | Municipality | County

APPLICANT INFORMATION:

Name and Title of Applicant | Company | Phone Number

Address | City | State | Zip Code

Email address | Fax Number

LEGAL NAME OF INDIVIDUAL, COMPANY, OR ENTITY TO WHICH PERMISSION WILL BE GRANTED:

Name | Name and Title of authorized signatory for company or entity

Address | City | State | Zip Code

PROJECT INVOLVES THE FOLLOWING IMPACTS TO BUCKEYE'S FACILITIES (CHECK ALL THAT APPLY):

- ☐ Cover, grading, and drainage pattern changes
- ☐ Aboveground and/or underground structures
- ☐ Road, driveway, sidewalks, and parking areas
- ☐ Utility crossings including gas, water (steam), sewer (storm & sanitary)
- ☐ Electrical, fiber-optic, and communications cables
- ☐ Temporary access roads for the crossing of heavy/construction equipment
- ☐ Railroad crossings
- ☐ Farming and field tile
- ☐ Construction-induced vibrations
- ☐ Blasting operations (attach BLASTING PLAN)
- ☐ Seismic vibrating operations (attach SEISMIC VIBRATING PLAN)
- ☐ Exposure of the pipeline (attach SUPPORT PLAN)
- ☐ Boring, drilling, or tunneling near the pipeline (attach DRILL PLAN)
- ☐ Other: _____

Page 1 of 3

APPLICATION MUST CONTAIN THE FOLLOWING:

☐ *Completed and Signed "Application for Design Plan Submission and Encroachment Review" Form*

☐ *Encroachment Application Fee** (see guidelines below)*

☐ *Design Plans (2 copies), depicting the following:*

☐ Field-verified location of Buckeye pipeline(s) location

_____	_____/_____/_____	_____
Name of Buckeye Employee	**Date of Pipeline Locating Activity**	**Design One Call No.**

☐ Field-verified depth of Buckeye pipeline(s) along all proposed road or utility crossings, drainage channels, and all other areas of proposed grade change within the pipeline right-of-way (attach a copy of any field data provided by Buckeye Representative)

_____	_____/_____/_____
Name of Buckeye Employee	**Date of Pipeline Depth Investigation**

☐ Buckeye pipeline(s) labeled as "___-inch High Pressure Petroleum Products Pipeline"

☐ Buckeye included on Utilities List, and Local Contact and phone number on plans

☐ Buckeye Pipeline(s) highlighted in yellow. List all plan sheets on which Buckeye facilities are located:

_____

☐ Location of ground disturbances (blasting, seismic testing, pile driving, jackhammering, etc. within 1,500 feet of Buckeye pipeline(s)

☐ Proposed location(s) where construction equipment will cross the pipeline right-of-way

☐ Structure setback distances from the pipeline right-of-way and from the nearest pipeline

☐ Proposed landscaping within 25 feet of either side of the pipeline(s)

☐ Any permanent fencing that will limit/encumber Buckeye's access to the pipeline right-of-way

☐ If the drainage pattern will be altered in any way over the Buckeye pipeline(s), a drainage plan that identifies new flow paths and all inlet/outfall/collection points

☐ Right-of-Way Use Restrictions specification included as part of final design plan (can be done by adding a drawing sheet to plans and appending (cut and paste) the specification onto this sheet.

For property improvements that involve grade/pavement alterations, road work (new construction or improvements of existing), utility crossings (buried and overhead), or other subsurface or on-surface structure installations within Buckeye's right-of-way:

☐ Separate plan and profile drawing of Buckeye pipeline(s) for existing and proposed conditions.

☐ Subgrade details that show materials and thickness of each paving layer/course.

☐ Amount of existing cover that will be removed or new cover added over the pipeline(s), and proposed final grade amount of cover over the pipeline(s).

☐ Clearances between Buckeye's pipeline(s) and any existing and new (buried or overhead) utilities that cross the pipeline right-of-way.

☐ Show the clearances between Buckeye's pipeline(s) and each proposed substructure at the two closest reference points.

☐ For any utility to be installed via boring, drilling, or tunneling, include a detailed procedure of this work with your design plans. Note: "Blind" boring is not permitted. Buckeye's pipeline(s) must be exposed during the bore operation to ensure that the bore head crosses safely underneath the pipeline(s).

☐ Indicate any areas of disturbance or other work that will require Buckeye's pipeline(s) to be exposed in order to perform your work.

☐ *Supplemental Plan Information (as applicable)*

☐ Blasting Vibrating Plan

☐ Seismic Vibrating Plan

☐ Support Plan

☐ Drill Plan

SUBMIT PLANS TO:

Buckeye Partners, L.P.
ROW Department
Attn: Encroachment Review
5 Tek Park, 9999 Hamilton Blvd.
Breinigsville, PA 18031

OR

bauman@buckeye.com
With subject line reading
"Encroachment Review Application"

Buckeye requires a minimum of 60 days for technical review upon receipt of complete application with all relevant fees and complete and accurate design plans. Submission of plans electronically to the above email address is encouraged and acceptable, but signed application and fees must follow by mail.

Relocation or Modification – Should the initial encroachment review result in a determination that Buckeye facilities must be relocated or modified because of the request, additional review time may be required. A Feasibility Study will be performed to prepare a scope of work, cost estimate, schedule and project plan; the cost of which will be borne by a party or parties other than Buckeye and must be paid before the relocation or modification will commence. A Technical Services Agreement between Buckeye and the responsible entity will be prepared to specify the duties of each party. A Letter of No Objection or Encroachment Agreement will be issued which will authorize the construction of the proposed encroachment under certain terms and conditions.

Permission / Notification - A fully-executed Letter of No Objection, Encroachment Agreement or Technical Services Agreement is needed prior to construction. Buckeye must be notified 10-days prior to construction to allow for the scheduling of a Buckeye representative to be present. It is also the encroaching entity's responsibility to notify the owners of any other pipelines, communication lines, other third party property or facility owners located within the proposed project area and to secure any additional needed rights from these parties where Buckeye's rights are limited.

APPLICATION FEES: A non-refundable Encroachment Application Fee must accompany all encroachment review requests for private development within Buckeye's right-of-way. Any request submitted without the required application fee, or that does not contain the specified information in the format requested on the application, may not be considered. Remit payment by check payable to: *Buckeye Partners, L.P.* Buckeye may require a developer to enter an agreement to pay any outside consultant costs that Buckeye deems necessary for a complete review of the proposed encroachment(s).

Initial Encroachment Application Fee is $2,500. Following initial review, all necessary plan resubmissions until plan approval shall be accompanied by a **Resubmission Fee** of **$750**.

Small Project Application Fee is $500. This reduced fee is reserved solely for single utility line service crossings or requests for installation of a fence or other residential-related improvement within Buckeye's pipeline easement.

I hereby authorize Buckeye to contact the Engineer/Survey firm which prepared the drawings, survey and attachments.

I certify that the information provided is accurate and I realize that incomplete information may delay processing or invalidate this application.

Signature of Applicant

By: _____

Name: _____

Title: _____

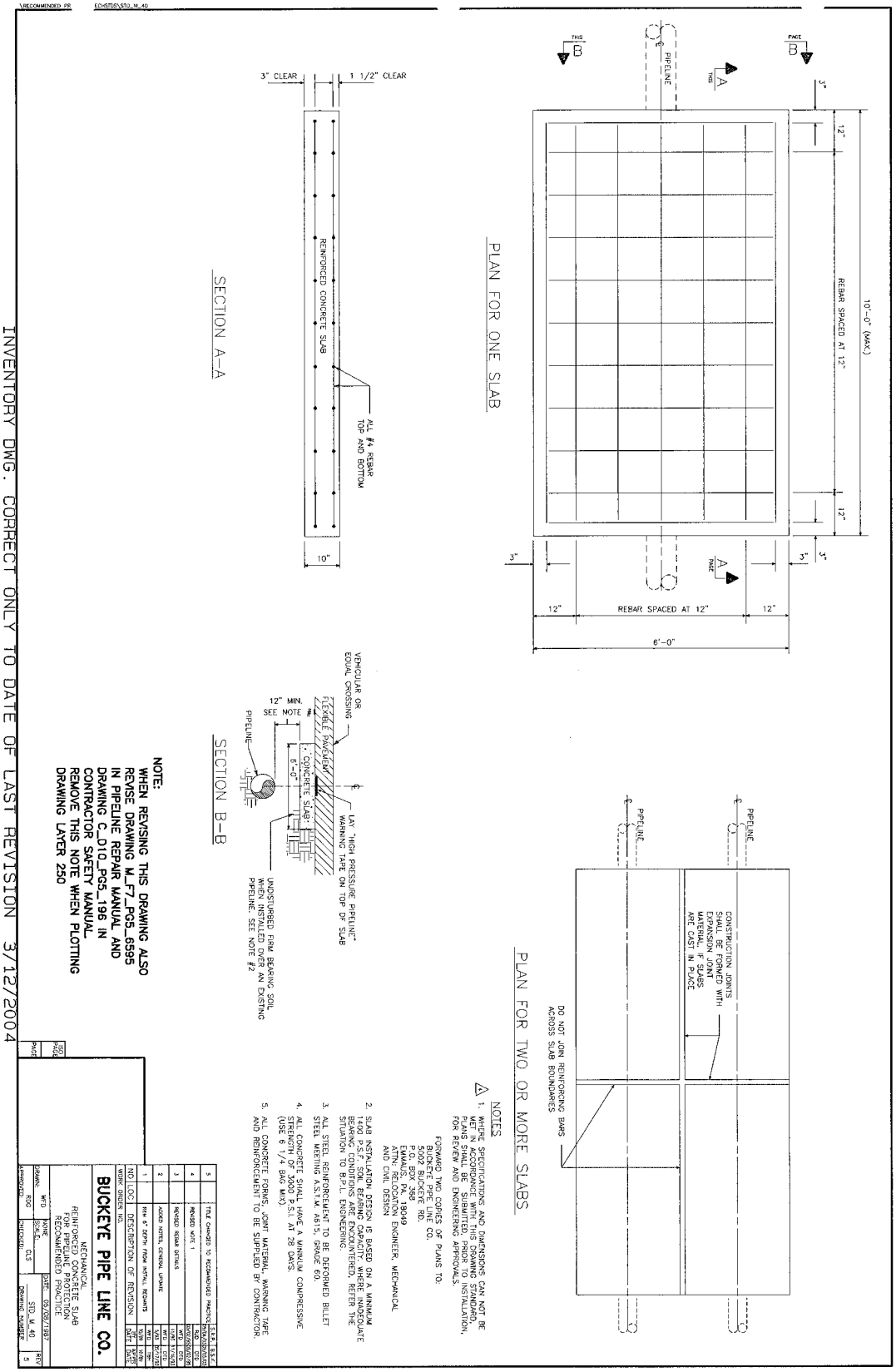
Date: _____

OFFICIAL USE ONLY

DATE REC'D: _____

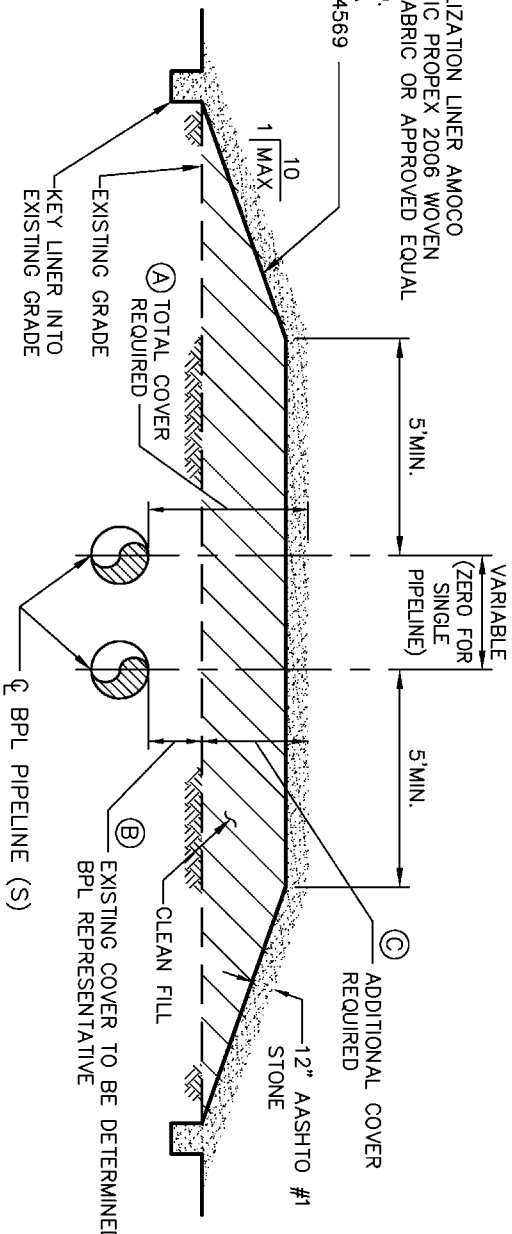
ENCROACHMENT
REVIEW NO.: _____

Page 3 of 3


PLAN FOR ONE SLAB
10'-0" (MAX.)
REBAR SPACED AT 12"
12"
3"
6'-0"
PIPELINE
SECTION A-A
3" CLEAR
1 1/2" CLEAR
REINFORCED CONCRETE SLAB
ALL #4 REBAR TOP AND BOTTOM
10"
SECTION B-B
VEHICULAR OR EQUAL CROSSING
FLEXIBLE PAVEMENT
CONCRETE SLAB
8'-0"
12" MIN. SEE NOTE #
LAY "HIGH PRESSURE PIPELINE" WARNING TAPE ON TOP OF SLAB
UNDISTURBED FIRM BEARING SOIL WHEN INSTALLED OVER AN EXISTING PIPELINE. SEE NOTE #2
PLAN FOR TWO OR MORE SLABS
CONSTRUCTION JOINTS SHALL BE FORMED WITH EXPANSION JOINT MATERIAL. SLABS ARE CAST IN PLACE
DO NOT JOIN REINFORCING BARS ACROSS SLAB BOUNDARIES
NOTES
1. WHERE SPECIFICATIONS AND DIMENSIONS CAN NOT BE MET IN ACCORDANCE WITH THIS DRAWING STANDARD, PLANS SHALL BE SUBMITTED, PRIOR TO INSTALLATION, FOR REVIEW AND ENGINEERING APPROVALS.
FORWARD TWO COPIES OF PLANS TO:
BUCKEYE PIPE LINE CO.
SOUTH BUCKEYE RD.
P.O. BOX 368
EMMAUS, PA. 18049
ATTN: RELOCATION ENGINEER, MECHANICAL AND CIVIL DESIGN
2. SLAB INSTALLATION DESIGN IS BASED ON A MINIMUM 1500 PSF ALLOWABLE CAPACITY. WHERE INADEQUATE BEARING CONDITIONS ARE ENCOUNTERED, REFER THE SITUATION TO B.P.L. ENGINEERING.
3. ALL STEEL REINFORCEMENT TO BE DEFORMED BILLET STEEL MEETING A.S.T.M. A615, GRADE 60.
4. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 P.S.I. AT 28 DAYS. (USE 6 1/4 BAG MIX).
5. ALL CONCRETE FORMS, JOINT MATERIAL, WARNING TAPE AND REINFORCEMENT TO BE SUPPLIED BY CONTRACTOR.
NOTE:
WHEN REVISING THIS DRAWING ALSO REVISE DRAWING M_F7_PG5_6595 IN PIPELINE REPAIR MANUAL AND DRAWING C_D10_PG5_196 IN CONTRACTOR SAFETY MANUAL. REMOVE THIS NOTE WHEN PLOTTING DRAWING LAYER 250
BUCKEYE PIPE LINE CO.
MECHANICAL
REINFORCED CONCRETE SLAB
FOR PIPELINE PROTECTION
RECOMMENDED PRACTICE
DRAWN: RDG
DESIGNED: WFD
CHECKED: CLS
DATE: 09/08/1989
DRAWING NUMBER: STD_M_40
REV: 5
INVENTORY DWG. CORRECT ONLY TO DATE OF LAST REVISION 3/12/2004

Project/Inquiry:	Loading:	Date:
System:	Pipe Data:	Revision:

GEOTEXTILE STABILIZATION LINER AMOCO
ENGINEERING FABRIC PROPEX 2006 WOVEN
POLYPROPYLENE FABRIC OR APPROVED EQUAL
AMOCO FABRIC CO.
ATLANTA, GEORGIA
PHONE: (770)944-4569



TEMPORARY (WET CONDITIONS) CONSTRUCTION RAMP
OVER BPL PIPELINE (S)
NO SCALE

NOTES:

1. RAMP SHALL BE 15 FOOT PLUS/MINUS WIDE WITH SIDES TAPERED ON A MINIMUM 1:1 SLOPE.
2. IF DRY CONDITIONS PREVAIL AT CROSSING SITE LINER AND STONE CAN BE REPLACED WITH FILL MATERIAL.

* Indicates item supplied by Buckeye Pipe Line Company.

Legend & Notes:

A. Required pipeline cover must be a minimum of: * feet
B. Existing pipeline cover is currently: TBD feet
C. Earthen ramp height above existing grade: * feet

Buckeye Pipe Line Company
Earthen Ramp Detail

Attachment 7: Blasting Plan Submission Form

INFORMATION SECTION

Blasting Contractor -

Company Name: _____

Phone: _____

Email Address: _____

Contact Person: _____

Contracted by -

Company Name: _____

Address: _____

_____

Contact Person: _____

Project Name: _____

Address: _____

*Latitude: _____

*Longitude: _____

Location and Distance (in feet) to Nearest Buckeye Pipeline: _____

_____

Date of Blasting: _____

EXPLOSIVES SECTION

Type of Explosives: _____

Max. Charge / Hole (lbs): _____

Charge Delay (ms): _____

Charge Weight / Delay (lbs): _____

Max. Depth of Charge (ft): _____

Max. Diameter of Charge (in): _____

Calculated Particle Velocity at a point -

Depth of Blast Area (ft): _____

Depth of Overburden (ft): _____

Type of Rock to be Blasted: _____

Density of Rock (lbs/cu-ft): _____

300 feet from pipeline (in/sec): _____

200 feet from pipeline (in/sec): _____

100 feet from pipeline (in/sec): _____

Directly above pipeline (in/sec): _____

ATTACHMENT CHECKLIST

- ☐ Drilling/Blasting Pattern Sketch - include all depths, measurements, and delay patterns relative to Buckeye facility involved and each charge.
- ☐ State Approval Letter
- ☐ Blasting Contractor's Qualifications
- ☐ Blasting Contractor's Insurance Certificate
- ☐ Blasting Contractor's Safety Plan

OMMISSION OF ANY INFORMATION REQUESTED ABOVE WILL DELAY YOUR BLASTING PLAN REVIEW

Buckeye requires a minimum of 14 days for technical review upon receipt of complete and accurate blasting plans

Attachment 8: Excavation Safety Checklist

195 F-09, FORM A – EXCAVATION SAFETY CHECKLIST

The information noted on this form is intended to communicate general information about our pipeline(s) and is not intended to be solely relied upon by any party for the purpose of excavation or any similar purpose.

By law, to enable all participating utilities time to mark their facilities, the **One Call Center** in your state requires notification by calling 811 prior to any excavation. Buckeye Partners, L.P. is a member of this One Call enterprise and will automatically be notified through this system. In addition, a Buckeye inspector will perform and/or review with the excavator representative the applicable checklist items below.

Pipeline Locate Activity:

☐ If plans are available, requested a copy of the written project plans and drawings for review with the excavator and/or engineer. Had the excavator and/or engineer explain the extent of the work area, location and depth of the excavation, type of proposed utilities, location of proposed utilities, number of utility crossings, etc.

☐ Established the pipeline(s) location and marked the line(s) per state One Call requirements throughout the entire work area.

☐ Photographed all established pipeline markings throughout the work area.

Communication with the Excavator and/or Engineer:

☐ **The excavator and/or engineer was advised that a Buckeye inspector must:**

- **Monitor the excavation site daily when work is performed within 25 feet of a Buckeye pipeline.**
- **Observe continuously all excavation and backfill activity performed within 10 feet of a Buckeye pipeline or during the installation of any utility across a Buckeye pipeline facility.**
- **In addition, the excavator was instructed to call 800-331-4115 if they were ready to excavate within either above distance of a Buckeye pipeline and a Buckeye inspector was not present. When called a Buckeye inspector will be sent to perform the inspection, which is free of charge.**

☐ The excavator was advised that only backhoes or trackhoes with a steel plate welded across the teeth of the bucket are permitted to be used during excavation work around a Buckeye pipeline.

☐ The excavator was advised that the Buckeye inspector is required by law to perform an external inspection of any Buckeye pipeline exposed during excavation activity. The excavator understands that he/she is responsible to provide an OSHA compliant excavation, allowing the Buckeye inspector safe ingress and egress to examine our exposed pipeline.

☐ Walked through the work area with the excavator and communicated the locations of all Buckeye pipelines in the planned work area.

☐ Discussed the number of pipelines, pipe size(s), approximate pressures, approximate depths, excavation tolerance zones, hand digging requirements, and the hazards and characteristics of product(s) in the pipeline system(s) located in the planned work area.

☐ The excavator was advised to call the One Call Center 811 or contact Buckeye, if the Buckeye markings are destroyed or need to be refreshed in the planned work area. This service is provided free of charge.

☐ The excavator was advised that before any exposed Buckeye pipeline can be backfilled, the Buckeye inspector will direct the placement of an orange warning mesh over the pipeline.

☐ The excavator was advised that **any contact** with the pipeline, pipeline coating, test station wiring, or anode beds **must be reported to Buckeye prior to backfilling the excavation** to permit further inspection of the damage to assure continued safe pipeline operations.

☐ The excavator was advised that failure to comply with the conditions outlined above would result in Buckeye requiring the excavator to expose the pipeline again to allow an examination of the pipeline at the excavator's expense. If damage to the pipeline is discovered, Buckeye may seek monetary compensation for all repair costs. Buckeye may also report this activity to all concerned parties (State One Call Center, Regulatory Agencies, Principal Contractor, Excavator's Insurance Company, etc.).

If you are unable to reach the representative designated below, or **in case of an emergency,** request assistance as follows:
For excavation activities in CT, FL, IL, IA, IN, MA, ME, MI, MO, NJ, NY, OH, PA, SC, and WI, please call 1-800-331-4115.
For excavation activities in LA, NV, TN, TX, and Southern California, please call 1-866-514-8380.
For excavation activities in Northern California, please call 1-800-307-1107.

One Call Ticket:		**Line Segments:**		
Work Order:		**Mile Posts:**		
Nearest Street				

Buckeye Information		**Property Owner / Excavator /Engineer**	
Date:		**Name:**	
Name:		**Phone:**	
Cell Phone:		**Signature:**	

Vector Pipeline®

Foreign Crossing Requirements

Updated: March 24, 2015

Vector Pipeline®

TYPICAL CROSSING REQUIREMENTS

A formal agreement is required before any foreign line, road, subdivision, or other facility crosses or encroaches upon an Enbridge operated pipeline and/or right-of-way, including Vector Pipeline. This document is not to be considered a formal agreement.

Definition A FOREIGN CROSSING is a facility (owned by a THIRD PARTY) crossing Enbridge's right-of-way or property. Facility includes:

1. "Highway/roadway", which includes, but is not limited to, any permanent or temporary: public road, private road, road allowance, street, lane, driveway, parking lot or any other public way.

2. "Utility", which includes, but is not limited to, any railway, irrigation ditch, drain, drainage ditch, sewer, dike, line for the transmission of hydrocarbons or any other substance, buried or aerial communication, and electrical power lines.

3. "Structure", which includes, but is not limited to, any permanent or temporary object which is constructed or installed over, across, along, upon, or under any pipeline or right-of-way.

4. "Other Activity", which includes, but is not limited to, excavation, regarding, heavy equipment crossings, seismic and blasting, or any other operation which poses a risk to the integrity of the pipeline and/or would require pipeline locating and monitoring.

I. APPROVAL AND NOTIFICATION

CONSTRUCTION APPROVAL: Written approval must be obtained prior to the start of any work within the pipeline right of way and easement. A complete set of drawings must be sent for review and approval prior to the start of any work to:

Attn: ROW: Vector
1100 Louisiana St, Suite 3300
Houston, TX 77002

Right of Way Contacts:

Helyna Bledsoe: Helyna.Bledsoe@enbridge.com
713-821-2278

Effie Nevils: Effie.Nevils@enbridge.com
713-821-1824

Drawings must show the horizontal and vertical location (plan and profile) of the pipeline, relative placement of the proposed crossing, and should adhere to the following minimum requirements:

Note: no exceptions to these requirements are permitted unless specifically approved in writing by Enbridge.

ONE CALL NOTIFICATION: Many states in which Enbridge operates provide "One-Call" notification
services which **must be** called at least 72 hours prior to any excavating activities.

Illinois	J.U.L.I.E.	800-892-0123
Indiana	I.U.P.P.S.	800-382-5544
Michigan	MISS DIG	800-482-7171

CONSTRUCTION NOTIFICATION: The Enbridge Crossing Coordinator for the region shall receive a minimum of 72 hours' notice from THIRD PARTY prior to commencing any work within the Enbridge right of way and easement.

II. UTILITY AND FOREIGN LINE CROSSINGS

NEW UTILITY CROSSING: The THIRD PARTY shall be responsible for obtaining a surveyed pipeline depth for each Enbridge pipeline crossed prior to submittal of engineering plans for approval. The minimum required number of depths shall be as follows:

1. Two points no more than 20 feet apart which must include the area of encroachment
    a. Encroachments exceeding a width of more than 20 feet may require additional survey points.*

* Additional points may be required as Enbridge deems necessary.

MINIMUM CLEARANCE: A minimum clearance of 24 inches is required between Enbridge's pipeline and any installed lines or appurtenances. All new utilities or foreign line crossings shall cross below Enbridge's pipeline.

Enbridge must approve in writing any utility or foreign line crossings which for practical reasons must cross above an Enbridge pipeline. Examples of utilities or foreign line crossings that require approval to cross above Enbridge pipelines include, but are not limited to, gravity water mains, pressurized water mains, communication mains, gas mains and drain tile. The organization seeking to install utility or foreign line crossings above Enbridge pipeline facilities must submit detailed plan and profile drawings showing the exact placement of the facility in relation to the Enbridge pipeline(s). Enbridge shall reserve the right to reject any utility or foreign line crossing if it interferes with pipeline maintenance activities or if minimum design standards are not met.

CROSSING ANGLE: All utilities or foreign lines must cross Enbridge's pipeline at a 90 degree angle to minimize interference, or a close as reasonably possible to 90 degrees. No crossing less than 45 degrees will be permitted.

PARALLEL UTILITIES: A minimum clearance of 20 feet on-center is required between Enbridge's pipeline and any parallel utility or foreign line.

III. SUBDIVISION REQUIREMENTS

NEW ROAD CROSSING: The THIRD PARTY shall be responsible for obtaining a minimum* of three (3) surveyed pipeline depths for each Enbridge pipeline crossed prior to submittal of engineering plans for approval. The location of the minimum required depths to be obtained shall be as follows:

1. Left edge of road right-of-way
2. Right edge of road right-of-way
3. Centerline of road right-of-way

* Additional depths may be required as Enbridge deems necessary.

INFORMING PURCHASERS: In order to protect the existing pipeline, deter encroachment by commercial and residential development, and promote public safety, the developer/owner shall inform purchasers of property encumbered with the right-of-way about the existence of the pipeline facilities and pipeline right-of-way. This can be achieved by incorporating the pipeline and pipeline right-of-way on all plot plans of subdivisions.

SILT FENCE: The developer, under Enbridge’s supervision, shall place silt fences parallel to and on each side of the pipeline during construction for the entire length of the developer's subdivision encumbered by the right-of-way.

MARKING SIGNS: Enbridge shall place pipeline marker signs on all developer's lots encumbered by the right-of-way.

IV. GENERAL REQUIREMENTS

DEPTH OF COVER: Permitted development over Enbridge's pipeline must be maintained at a minimum of five (5) feet of cover. Changes in topography of the right-of-way must be approved in writing by Enbridge.

SPACING: FOREIGN FACILITY spacing is subject to Enbridge approval in order to ensure the safe future operation and maintenance of Enbridge pipelines. Minimum spacing requirements can be found in Appendix One.

HEAVY EQUIPMENT CROSSING: Heavy equipment is defined as any equipment that can cause “rutting” or poses a risk to the integrity of the pipelines as determined by Enbridge. To ensure that total circumferential pipe stress does not exceed specified limits, the pipeline must not be crossed when depth of cover of the pipeline is less than 60 inches. It may be necessary to install temporary ramps over the pipeline. If deemed as a requirement by Enbridge, the ramps must be used as the sole point of travel across the pipeline.

BACKFILLING: If a utility or foreign crossing is installed across Enbridge's pipeline by open-cut methods, appropriate measures shall be taken to prevent trench/pipe settlement. This will be accomplished by backfilling the excavation in lifts not-to-exceed one (1) foot and compaction of each lift to 95% of the Standard Proctor Density.

EXCAVATIONS: All mechanical digging equipment approved to work within Enbridge's easement must have the teeth removed or barred with a plate welded across the teeth. Mechanical excavation will cease once the earth has been removed to within two (2) feet of Enbridge's pipeline. Shovels must be used to manually clean the area above and below the pipeline. After the pipeline has been initially located, the pipeline shall be kept visible to the equipment operator during the excavation process. Enbridge may require shoring or another type of support to protect the pipeline's integrity. All backfill on Enbridge's easement shall be mechanically compacted to the top of the pipeline

CONSTRUCTION INSPECTION: Enbridge reserves the right to require THIRD PARTY to cover the costs associated with a third party inspector. Enbridge will make the determination based on the submitted drawings and details of the FOREIGN FACILITY.

"AS-BUILT DRAWINGS": Upon completion of the construction of the utility, foreign crossing, roadway, or subdivision, the THIRD PARTY will provide an "As Built" drawing of the FOREIGN FACILITY to Enbridge (as indicated in Section I) within 30 days after construction completion.

FACILITY ALTERATIONS: Any improvements or changes to the FOREIGN FACILITY upon Enbridge's right-of-way shall require the prior written approval of Enbridge.

COSTS: The THIRD PARTY, shall bear all expenses incurred in connection with the construction, operation, and maintenance of the FOREIGN FACILITY.

REGULATORY COMPLIANCE: The THIRD PARTY shall conduct activity upon Enbridge's right-of-way in compliance with all applicable federal, state, and local statutes, rules, and regulations and shall obtain all permits necessary for compliance with said statutes, rules, and regulations.

RIGHT-OF-WAY ACTIVITY: The THIRD PARTY shall conduct activity upon Enbridge's right-of-way in a manner which will not interfere with the rights of Enbridge in the use and enjoyment of its right-of-way grant or endanger the integrity of Enbridge's pipeline facilities and such activity shall be conducted in a clean and responsible manner.

LIABILITY: The THIRD PARTY agrees to assume all risk or liability for damages to any of Enbridge's property or facilities resulting from the THIRD PARTY 's activity upon Enbridge's right-of-way. The THIRD PARTY further agrees to indemnify and hold Enbridge harmless for any and all environmental damages, damages to property of third parties or any injury to or death of any person resulting from the THIRD PARTY 's activities upon Enbridge's right-of-way unless such damage, injury, or death results from Enbridge's sole negligence.

CHANGES IN LAND USE: A change in land use over the pipeline (i.e. farmland to a road) may require Enbridge to upgrade its facilities. The cost associated with performing this upgrade shall be entirely borne by the THIRD PARTY.

FUTURE ENBRIDGE WORK: Enbridge shall not be responsible for any costs incurred to remove, repair, replace, or improve the FOREIGN FACILITY in the event that Enbridge finds it

necessary or desirable to conduct repairs or maintenance of its facilities or construct additional facilities, including, but not limited to, additional pipelines, in the future upon the right-of-way which result in damage or disruption to the FOREIGN FACILITY. Further, Enbridge does not warrant that repairs or maintenance of its existing facilities or construction of additional facilities upon the right-of-way will not be conducted in the future. To the extent Enbridge incurs any measurable increased cost in the future to maintain, alter, repair, operate and/or replace its pipeline(s) as a result of the FOREIGN FACILITY (as compared to the cost that would otherwise be incurred by Enbridge if such improvements had never occurred), then THIRD PARTY shall reimburse Enbridge on such occasions for the difference between such increased cost and the cost which Enbridge would otherwise incur. For example, if pavement is placed over or near the pipeline(s) thereby making access to such pipeline(s) more burdensome, then at such time, if ever, when such access becomes necessary, THIRD PARTY will be obligated to reimburse Enbridge for the resulting increase in the cost of gaining such access.

INSURANCE REQUIREMENTS: Prior to commencement of construction, the THIRD PARTY shall provide proof of comprehensive general liability insurance providing coverage of no less than Two Million Dollars ($2,000,000) for property damage and injury to or death of any person. Such insurance coverage shall be maintained for 24 months from the date of completion of construction of the Foreign Facility. Enbridge shall be named as additional insureds to the THIRD PARTY policy.

V. EXPLOSION/VIBRATION IMPACT

PEAK PARTICLE VELOCITY: The maximum peak particle velocity (ppv) that the pipeline should be subjected to is 4 inches/second.

PILE DRIVING: As a general rule, pile driving should not be undertaken within 50 feet of the pipeline. In any case, the peak particle velocity specified above must not be exceeded.

BLASTING: Any blasting must be approved in writing by Enbridge.

In case of Emergency, contact
Vector Pipeline Gas Control: 1-888-427-7777

Appendix One
Spacing Guidelines

ENCROACHMENT DESCRIPTION	OFFSET FROM PIPELINE (FEET) VERSUS PIPE SIZE 2" - 12"	14" – 24"	Over 24"
I. **ABOVE GROUND STRUCTURES AND APPURTENANCES**			
A. Buildings			
Any enclosed structure permanent in nature regardless of purpose	35	45	60
B. Utilities			
Utilities may cross pipelines at right angles. Distances specified are for parallel Encroachments. (See guys and anchors if applicable.)	Crossing of Company Pipelines by		
1. *Electric power and telephone lines*	35	35	50
2. *Television cables*	25	35	50
C. Miscellaneous			
1. *Campground:* If within 660 feet of pipeline, see Engineering Standard 0060, Class Location Determination.	---	---	---
1. Fences: Distances specified are for parallel fences.	25	35	50
3. *Guys and Anchors:* No guys or anchors will terminate within the minimum distance specified. The guy or anchor must have a vertical clearance of 18 feet minimum within the specified distance of the pipeline.	35	40	55
4. *Mobile Homes:*	35	45	60
5. *Nursery Stock* (including Christmas Trees No minimum is small and used as cash crop. Consult Company right-of-way personnel to establish agreement before planting.	---	---	---
*6. Poles (*See also guys & anchors, towers, electric power lines): Telephone, power, etc. and sing boards including supports.	30	40	55
7. *Stored Materials* Permitted over pipeline if of a type that can be readily relocated and of weight not detrimental to the pipeline.	---	---	---
8. *Swimming Pools* Permitted over pipeline if readily removable. Distances specified are for partially below grade or permanent in nature.	35	45	60
9. *Towers (*See also guys and towers)	75	100	100
10. *Trees & Shrubs (*See also nursery stock) Permanent (perennial) trees, shrubbery or other landscaping that would impair access to the pipeline.	30	40	55

ENCROACHMENT DESCRIPTION	OFFSET FROM PIPELINE (FEET) VERSUS PIPE SIZE 2" - 12"	14" – 24"	Over 24"
II. SURFACE IMPROVEMENTS, MODIFICATIONS AND ACTIVITIES			
A. Pavement			
Pavement includes asphalt and concrete or variations thereof. May cross pipeline at near right angles or be placed parallel to pipeline at distance specified.			
1. *Air Strips:*	30	40	55
2. *Alleys, Driveways, Roads, Sidewalks, Tennis (or other) Courts:*	25	35	50
3. *Parking Lots:*	---	---	---
Consult Company right-of-way personnel to establish agreement for "green belts", etc.			
4. *Patios:*	25	35	50
If roofed & fenced, consider as building; otherwise as specified			
B. Earthwork or Other Grade Modifications			
Ensure 36" minimum cover (or existing if <36") is preserved over pipeline. Cover may be added if free or foreign debris such as large rocks, concrete chunks and metal scraps. Operation of heavy equipment over the pipeline must provide for appropriate safeguard of pipeline integrity.			
1. *Ditches:*	30	40	55
Should cross at near right angles. Parallel distances to be as specified. Minimum cover shall be 36" from bottom of ditch to pipeline.			
2. *Roads:*	---	---	---
Minimum cover shall be **48"** from top of road to pipeline.			
3. *Landing Leveling:*	---	---	---
Permitted over pipeline if cover requirements are maintained.			
4. *Plowing (*including deep tilling or chisel plowing):	---	---	---
Permitted over pipeline if minimum clearance of 12" is maintained between plow depth and top of pipeline.			
5. *Terracing (*See land leveling):			
6. *Dams & Dikes (*including waterways & water impoundments):	30	40	55
7. *Dredging:*	30	40	55
C. Seismography: Calculate distances allowed based on Engineering Standards 7155.	See Engineering Standard 7155, Effects of Blasting on Buried Pipelines.		

ENCROACHMENT DESCRIPTION	OFFSET FROM PIPELINE (FEET) VERSUS PIPE SIZE 2" - 12"	14" - 24"	Over 24"
III. BELOW GROUND STRUCTURES AND APPURTENANCES			
A. Pipelines and Utilities			
1. *Drain Tile:*			
May cross pipeline. Distances specified are for parallel tile lines.			
a. Tile diameter less than 10"	25	35	50
b. Tile diameter 10" or greater:	30	40	55
2. *Pipeline (*water, gas, oil, well, sewer, etc.):	30	40	55
It is preferred that pipelines greater than 2" undercrosss Company pipelines. Minimum clearance should be 24". Distances specified are for parallel pipelines.			
3. *Power Lines:*	30	40	55
It is preferred that all crossings are under Company lines at near right angles. Minimum clearance should be 36". Cables having conductor at more than 60 volts to ground should be non-metallic casing for a minimum distance of 10' on either side of the pipeline with six inches of red colored concrete for a distance of 10 feet on each side of Company's pipeline installed per National Electrical standards. Distances specified are for parallel power lines.			
4. *Communication Lines:*	30	40	55
It is preferred that cables undercrosss pipelines at near right angles. Minimum clearance should be 12". Exception may be made where it would be necessary to cut and splice the cable. When laid over the pipeline, the cable must be cased for a minimum distance of 1.5' on either side of the pipeline or otherwise protected. Distances specified are for parallel communication lines.		---	---
B. Miscellaneous			
1. *Blasting:*	See Engineering Standard 7155, Effects of Blasting on Buried Pipelines.		
Calculate distance allowed based on Engineering Standard 7155. Notify blasting contractor of pipeline location and limits of blasting activities.			
2. *Mines (*mining):	---	---	---
Notify Company Technical Office whenever mining or quarrying is proposed within 660 feet of pipeline. Notify mining contractor of pipeline location.			
3. *Leach Beds:*	30	40	55
Lines crossing pipeline will be of solid impervious material.			
4. *Septic System:*	30	40	55

ATTACHMENT 16-1

UNIQUE SPECIAL PROVISIONS:

Intelligent Transportation Systems (ITS)

A. Traffic Detectors....1
B. Roadway Weather Information System....6
C. Closed-Circuit Television Cameras....7
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TRAFFIC DETECTORS

Microloops

Except as otherwise provided herein, magnetic microloop vehicle detectors shall be installed under pavement. Design-Build Contractor shall provide handholes and cross-roadway conduit at detector locations to provide convenient access to the microloops for maintenance.

Two detectors shall be provided at each location for a speed trap configuration. Magnetic microloops shall be installed under pavement. Design-Build Contractor shall provide handholes and cross-roadway conduit at detector locations to provide convenient access to the microloops for maintenance.

Materials

Design-Build Contractor shall be responsible for furnishing, insuring, and transporting all materials associated with the microloop detector assembly and the controller cabinets.

All materials shall be furnished in accordance with the material requirements as stipulated under Project Standards, including probe sensors, lead-in cables, conduits, pullboxes, home-run cables and splice enclosure kits, traffic monitoring controllers, controller cabinets, and all communication interfaces between the controllers to the lane probes and to the center.

Materials shall be as follows or Department approved equivalent:

1. Canoga 922 2-Channel Vehicle Detector Card
2. Canoga Vehicle Detector Card Power Supply
3. 3M Scotchcast 3831 Buried Service Wire Splice Installation Kit
4. Canoga 3003 Home Run Cable

Design Criteria

The microloop detectors shall be designed and installed in and protected by conduits. Design-Build Contractor shall coordinate the design and installation of microloop detectors with the pavement design and construction.

Construction Requirements

The microloop detectors shall be inserted into 3-inch PVC conduit placed below the pavement surface as specified by the manufacturer. For multiple lanes, multiple microloop probes shall be placed and interconnected in a series to obtain required lane coverage and to remove magnetic-induced noises. All lead-in cables shall be spliced into the home-run cables in splice enclosures in pullboxes along the roadside, which shall be sealed and insulated from water damage in accordance with manufacturer’s specifications.

The traffic monitoring controller shall be configured to communicate with field probes to detect vehicle volumes along with user-defined classifications, speeds, and occupancies by lane in user-defined intervals (typically 2 minutes to 15 minutes) with accuracy levels in accordance with

manufacturer's specifications. For any time interval the maximum error rate shall not exceed ±5 percent compared with ground truth vehicle data obtained visually over a 15-minute period for every detector installation. The error rate shall be determined using visual counts and speeds measured with a radar gun. The test shall be performed by the Contractor in the presence of the Engineer. If detector sensitivity or calibration settings are adjusted in order to meet this test, the new settings shall be recorded on the wiring diagram in the cabinet.

For vehicle counts, use the following standard Department form:

RTMS ID #			NOTES					
LOCATION								
FINE TUNE								
SENSITIVITY								
SAVED FILE NAME			When verifying counts a minimum of 50 vehicles must be counted					
BARRIER/TYPE	YES/NO		BETWEEN LANES					
ZONE	1	2	3	4	5	6	7	8
DIRECTION								
LANE (FAST MID SLOW)								
MANUAL COUNT								
RTMS Lap Top COUNT								
% ERROR								
MESSAGE PERIOD____ [SECS]	POLL MODE ___		TECH INIT		APPROVED			

All interface cables and communication ports shall be connected and configured to complete the communications and control from center to field cabinet and from field cabinet to lane probes.

At a minimum, the detector shall provide the following vehicle classes on Table 4-A-1, FHWA Traffic Monitoring Guide:

Vehicle Class	Recommended Length
Passenger vehicles (PV):	<13 feet
Single unit trucks (SU):	13 - 35 feet
Combination trucks (CU):	35 - 61 feet
Multi-trailer trucks (MU):	61 - 120 feet

The microloop detectors shall also be configured to detect and report stopped or dysfunctional vehicles in the direction of travel. Application-specific software shall also be provided to enable traffic data reporting and Incident detection in the TMC.

Design-Build Contractor shall provide power and communications connections to the control cabinet to which the microloop detectors report to transmit traffic data to the TMC for traffic management and Incident detection.

Microwave Radar Detectors

Microwave radar detectors shall be used where conditions are not appropriate for the installation of microloop detectors. These locations shall be approved by INDOT.

Materials

Design-Build Contractor shall be responsible for furnishing, insuring, and transporting all materials associated with the microwave radar detector assembly and the controller cabinets. The Microwave Detector shall include the following items:

1. Microwave Detector Unit with mounting plate installed
2. Mounting ball-joint bracket and 1-inch lynch-pin
3. Matching MS plug and back-shell, D-Type 9-pin RS-232 connector and back-shell
4. Ready-made 8-zone cable (cable length as required)
5. Calibration and operating software and software licenses for all locations

All mounting hardware, conduit, conduit bushings, conduit straps, cables, serial converter, power converter, surge suppressor, wires, connectors, support attachment arms, grounding wires, ground rods, grounding cables, weather heads, etc. necessary to complete the Microwave Detector as specified herein shall be supplied and installed as recommended by the manufacturer.

Design Criteria

The microwave radar detectors shall be designed, furnished, and installed side-fired on equipment poles or structures (e.g., overhead sign supports). The detectors and equipment cabinets shall be roadside-mounted and continuous along roadways, with a maximum spacing of 0.3 miles. Pending Engineer approval, spacing may be adjusted slightly when in the vicinity of a CCTV camera installation site, such that detectors are co-located with the nearby CCTV camera sites.

The microwave ranging radar detectors shall be installed on all newly constructed roadways and interchanges to provide traffic monitoring and travel-time detection. For highway installations, the detectors shall provide the following traffic data measurements with the accuracy stipulated by Department TMC:

1. Vehicle volumes by lane
2. Travel speeds by lane
3. Vehicular occupancy by lane

A field controller shall be provided to process the field data collected from the detector and transmit to INDOT TMC. Design-Build Contractor shall be responsible to install and align each detector with adequate setback distance in accordance with the manufacturer's requirements to provide radar coverage over the entire detection zones. In any case that a detector's location is within the clear zone, safety guide railings or traffic barriers shall be provided for protecting ITS devices and their supports as required by state and Occupational Safety and Health Administration (OSHA) standards.

Construction Requirements

Design-Build Contractor shall be responsible for the design and installation of the microwave radar detectors. The microwave radar detectors shall be aligned and aimed to the target roadway, with clear coverage of traffic without the interference of any other microwave devices or vertical surfaces such as bridges. The setback distance and mounting height shall be site-surveyed and approved in accordance with the manufacturer's requirements to allow maximum detection coverage over all lanes.

Design-Build Contractor shall provide power and communications connections to the control cabinet connecting to microwave radar detectors. The composite power and data cable shall meet the manufacturer's specifications on communications protocol requirements and shall be continuous without splices between the cabinet and the detector assembly. Cable ends shall be kept sealed at all times during installation using an approved end cap until connectors are installed. Tapes shall not be used to cap the cable end at any time.

Wireless Sensor Detection System

Wireless sensor detection shall be used where conditions are not appropriate for the installation of microloop detectors. These locations shall be approved by INDOT.

Materials

Design-Build Contractor shall be responsible for furnishing, insuring, and transporting all materials associated with the wireless sensor detection system.

Wireless sensors shall be rugged and designed to fully operate in the outdoor, in-pavement environment. The sensor housing shall meet NEMA Type 6P enclosure rating and IP68 ingress protection.

Sensors shall have multi-axis magnetic field sensing and shall self-calibrate automatically. The sensors shall have a battery life of at least 10 years. Sealant shall be a fast-drying epoxy suitable to withstand the long-term, harsh conditions of the roadway.

Access point shall provide bi-directional wireless communications with the sensors. It shall enable the unique addressing and configuring of each sensor and the wireless upgrading of firmware. Operating software and software licenses for all locations shall be provided to the Department.

Repeaters and radios shall be provided if required to ensure reliable communications between the in-pavement sensors and the access point controller. The repeaters and radios shall be from the same manufacturer as the wireless sensors and designed specifically for this function.

All mounting hardware, straps, cables, power supplies, surge suppressor, wires, connectors, support attachments, grounding wires, ground rods, grounding cables, weather heads, etc. necessary to complete the wireless sensor detection system as specified herein shall be supplied and installed as recommended by the manufacturer.

Design Criteria

The wireless sensor detection system access points and repeaters shall be designed, furnished, and installed on equipment poles or structures (e.g., overhead sign supports). The installation and spacing of in-pavement wireless sensors, repeaters, access points and radios shall be in accordance with the manufacturer's instructions.

The wireless sensor detection system shall be installed on newly constructed roadways and interchanges to provide traffic data monitoring. For highway installations, the detectors shall provide the following traffic data measurements with the accuracy stipulated by Department TMC:

Vehicle volumes by lane

1. Travel speeds by lane
2. Vehicular occupancy by lane
3.

A field controller shall be provided to process the field data collected from the detector and transmit to INDOT TMC. Design-Build Contractor shall be responsible to install each sensor at the proper depth and sealing in accordance with the manufacturer's requirements to provide optimal readings and performance. In any case that a support structure for wireless sensor detection equipment is within the clear zone, safety guide railings or traffic barriers shall be provided for protecting ITS devices and their supports as required by state and Occupational Safety and Health Administration (OSHA) standards.

Construction Requirements

Design-Build Contractor shall be responsible for the design and installation of the wireless sensor detection system. The in-pavement wireless sensors shall be centered in each lane and installed at the proper depth and sealing for optimal performance in accordance with manufacturer's instructions. Each lane shall have a pair of sensors installed for speed measurements. The distance between pairs of sensors shall be a preset distance and configured in the software according to the manufacturer's instructions. At each site, a wireless sensor shall be installed in each lane and configured in the system.

ROADWAY WEATHER INFORMATION SYSTEM

Materials

Design-Build Contractor shall be responsible for furnishing, insuring, transporting, and storing (for the interim) all materials associated with RWIS and control cabinets. Materials include sensors for pavement surface conditions, subsurface temperature probes, atmospheric sensors, wind speed and direction detectors, precipitation and visibility sensors, and video imaging for precipitation and moisture.

Design Criteria

The Road Weather Information System (RWIS) shall provide both air and pavement surface weather data, including the following:

Atmospheric data: temperature, precipitation, visibility, humidity, solar radiation, remote camera imaging, and wind data.

Surface/subsurface data: pavement temperature, subsurface temperature, surface condition, amount of de-icing chemical on roadway, and freezing point.

Design-Build Contractor shall be fully responsible for the design, fabrication, and installation of the RWIS and control cabinets. Design-Build Contractor shall be responsible for the design and installation of maintenance platforms, and safety guide railings or traffic barriers if within clear zones, as required by OSHA.

Construction Requirements

Design-Build Contractor shall be responsible for the installation of the RWIS and control cabinets.

Design-Build Contractor shall provide power and communications connections to the RWIS and control cabinets in accordance with requirements of the RWIS manufacturer to provide a complete RWIS system. The Design-Build Contractor shall coordinate with the utility to establish electrical service for RWIS equipment.

Manufacturer software shall be configured for data monitoring and detecting alarms/warnings from pavement and subsurface probes of the proposed RWIS using approved thresholds.

Closed-Circuit Television Cameras Materials

Camera dome with PTZ shall be manufactured by: Honeywell ACUIXTM PTZ Dome model HDXGNWACW

The contact information for the cameras and associated equipment is as follows:

Mr. Perry Wolfe
P.T. Wolfe Associates Inc.
2017 Garey Rd. NE
Junction City, OH 43748
Telephone: 740-987-2550
Fax: 740-987-2477
Mobile Phone: 740-503-2148

Design-Build Contractor is responsible for maintaining current contact information after the publish Setting Date.

Design Criteria

CCTVs shall be designed to mount on camera poles/towers in open-space areas. Special connections shall be provided to mount CCTVs on bridge structure, and locations shall be approved by INDOT as part of the Design Review process. All cameras shall be located within the Project ROW.

Design-Build Contractor shall be responsible for CCTV assembly and camera composite cable. Design-Build Contractor shall be responsible to provide an ARIES Field Processors (AFPs) for video encoding, decoding, and pan-tilt-zoom (PTZ) control between the field and TMC or a Treehaven CCTV Field Controller, or approved equal, for video encoding, decoding, and pan-tilt-zoom (PTZ) control between the field and TMC. Camera towers shall be used. Towers shall be designed in compliance with the Project Standards on pole sizes, foundations, concrete paving, and lightning protection, and shall be located in areas where access to equipment shall not require traffic control. Otherwise, the towers shall be protected by safety guide railings or traffic barriers. Each tower shall have a foundation and a concrete work pad for maintenance.

Design-Build Contractor shall be responsible for design, structural calculations, fabrication, installation of the CCTV camera assembly, AFPs or CCTV field boxes, camera pole/tower, lowering device assembly, pole foundation and other Incidentals including fence and gate, tower grounding and lightning protection. Final camera locations shall be coordinated with the roadway design and shall be submitted to INDOT for approval. Design-Build Contractor shall be responsible for all testing of video transmission between cameras and the TMCs in Indianapolis and Gary to provide a fully functional CCTV subsystem.

1.

2. **CCTV Assembly**

CCTV assembly shall have the following components:

3.

One camera dome with PTZ

One camera lowering system as necessary

CCTV composite cable

Construction Requirements

All installation services shall comply with all manufacturer's instructions and warranty provisions and warranty contract maintenance services and Department electrical codes. All wiring entry to the camera dome shall use watertight fittings. All materials shall be installed in a neat and professional manner. All wiring entry and exits shall be made at the side or underneath components; no exposed top entry or exits are permitted. This requirement extends to all enclosures, junction boxes, support arms, or any other externally exposed devices.

Camera Lowering System

Materials

The camera lowering system shall be designed to support and lower a standard closed-circuit television camera, lens, housing, pan-tilt-zoom (PTZ) mechanism, cabling, connectors, and other supporting components without damage or causing degradation of camera operations. The camera lowering device and the tower are interdependent upon each other and thus, must be considered a single unit or system. The lowering system shall consist of a coax contact unit, self-aligning divided support arm, an adapter for attachment to a tower, and a camera connection box. The divided support arm and receiver brackets shall be designed to self-align the contact unit during installation and insure the contact unit cannot twist under high wind conditions. The camera-lowering device shall withstand wind forces of 100 mph with a 30 percent gust factor using a 1.65 safety factor. The lowering device shall effectively operate within a temperature range of −40 to 191°F. The lowering device manufacturer shall furnish independent laboratory testing documents certifying adherence to the stated wind force criteria utilizing, as a minimum effective projected area EPA, the actual EPA or an EPA greater than that of the camera system to be attached. The camera-lowering device to be furnished shall be the product of manufacturers with a minimum of 2 years of experience in the successful manufacturing of such systems. The lowering device provider shall be able to identify a minimum of 3 previous projects where the purposed system has been installed successfully. Camera lowering system shall be provided by one of the following manufacturers or Department approved equivalent:

[MG]2 Inc.

Camera Lowering Systems, Inc.

The lowering device manufacturer shall furnish a factory representative to assist with the assembly and testing of the first lowering system onto the tower assembly. The Contractor shall ensure the Camera Lowering System Vendor coordinates with the Camera Tower Vendor to ensure proper integration of the Camera Lowering System and Camera Tower. At the time of future installation of the lowering device, the manufacturer shall furnish the Department documentation certifying that the Contractor has been instructed on the installation, operation and safety features of the lowering device.

All pulleys for the camera lowering tool shall have sealed, self-lubricated bearings, oil tight bronze bearing, or sintered bronze bushings. The lowering cable shall be a minimum 1/8-inch-diameter stainless steel aircraft cable with a minimum breaking strength of 1,740 pounds with seven strands of 19 gauge wire each.

The camera lowering system shall be capable of lowering the camera to the ground without contacting the pole/tower structure or anything attached to the tower structure. A guide cable shall be provided to prevent interference with the tower structure. The guide cable shall be 5/32 inch diameter stainless steel and shall be a manufacturer provided component. The cable guide shall be installed per manufacturer's recommendations. The guide cable shall be mounted to minimize the impact on the camera's view of the roadway, and shall have the ability to be disconnected from the ground mounting point to maximize the camera's view.

All electrical and video coaxial connections between the fixed and lowerable portion of the contact block shall be protected from exposure to the weather by a waterproof seal to prevent degradation of the electrical contacts. The electrical connections between the fixed and movable lowering device components shall be designed to conduct 56,000 bps RS422/485 or RS-232 data and one volt peak-to-peak video signals as well as the power requirements for operation of dome environmental controls.

The interface and locking components shall be made of stainless steel and/or aluminum. All external components of the lowering device shall be made of corrosion-resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to a corrosive environment. A weephole with screen shall be included on the underside of the weight box.

The lowering system shall include the following basic components:

1. Coaxial contact unit
2. Self-aligning divided support arm
3. Adapter for attachment to tower
4. CCTV control cable junction box at the top of the tower
5. Permanent mount lowering tool

Coax contact unit

The suspension contact unit shall have a load capacity 200 pounds with a 4 to 1 safety factor. There shall be a locking mechanism between the fixed and movable components of the lowering device. The movable assembly shall have a minimum of two latches. This latching mechanism shall securely hold the device and its mounted equipment. The latching mechanism shall operate by alternately raising and lowering the assembly using the winch and lowering cable. When latched, all weight shall be removed from the lowering cable. The fixed unit shall have a heavy-duty cast tracking guide and means to allow latching in the same position each time. The contact unit housing shall be weatherproof, with a gasket provided to seal the interior from dust and moisture.

The prefabricated components of the lift unit support system shall be designed to preclude the lifting cable from contacting the power or video cabling. Design-Build Contractor shall supply a means of separating the power and video cabling from the lowering cable if required by the Design Documents or Engineer. The only cable permitted to move during lowering or raising

shall be the stainless steel lowering cable. All other cables shall remain stable and secure during lowering and raising operations.

The coax connector block consists of DIN Housing containing thermoplastic insulation bodies that hold the individual contacts. Guide pins and guide bushings shall prevent misconnections and provide accurate mating without relying on the contact pins to provide alignment. There shall be a minimum of 12 -.06-in. contacts and 1-75 Ohm contact. The max current rating for each pin shall be at least 13 amps. The signal and power wires shall be crimped using an industry standard 8-point crimp tool. The video cable shall be 75 ohm coax not to exceed a length of 1,000 feet. The cable loss with the connectors shall not exceed 0.8 decibels per 100 feet at 5 megahertz. The camera cable shall be made up with the coax connector block in the factory and sealed with electrical insulating. The entire coax connector block shall be sealed from external dust and moisture when in the mated condition by means of a gasket.

Divided support arm

The divided support arm and receiver brackets shall be designed to self-align the contact unit during installation and ensure the contact unit cannot twist under high wind conditions.

Lowering tool

The camera-lowering device shall be operated by use of a permanent mount lowering tool. The lowering tool shall be provided with an adapter for operating the lowering device by a portable drill using a clutch mechanism. The clutch mechanism, but not the portable drill, shall be provided for each site. The lowering tool shall be equipped with a positive locking mechanism to secure the cable reel during raising and lowering operations. The lowering tool shall be made of durable and corrosion-resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coating to withstand exposure to a corrosive environment. Lowering tool shall be installed in the stainless steel, or aluminum enclosure, rated 3R, mounted to the tower.

Construction Requirements

Installation

The Camera Lowering System shall be installed in accordance with the manufacturer’s instructions. All materials shall be installed in a neat and professional manner. All installation services shall comply with all warranty provisions and warranty contract maintenance services. All installation services shall comply with all local and state electrical codes, and Motorola R-56 requirements. Installation of the Camera Lowering System shall be coordinated with INDOT to determine actual mounting height and azimuth. Typically, the camera lowering system azimuth will be perpendicular to the mainline lanes.

1. **Manufacturer Testing**

2. Prior to the delivery of the camera lowering system, the manufacturer will test for the following:

Electrical continuity.

Direct connectivity to ground for an open circuit of 120 volts

The results of these tests will be supplied to INDOT with each camera lowering system upon delivery.

Certification

Design-Build Contractor shall provide a 916.02(c) Type C certification from the vendor verifying the CCTV control cable was properly installed and tested before delivery to Design-Build Contractor.

Warranty

Design-Build Contractor shall provide a manufacturer's warranty against defects in material and workmanship for a period of five years after Final Acceptance of each complete installation. Design-Build Contractor shall include labor for removal and reinstallation of a failed unit. Warranty shall include complete connector assembly replacement for contacts failing due to water ingress and corrosion damage.

Composite Cable

Materials

CCTV composite cable shall be provided by manufacturers including Treehaven Technologies or Department approved equivalent. CCTV composite cable shall conform to specifications of UL/NEC/CEC CATV or CM with Flame Resistance of Underwriters Laboratories (UL) 1581 Vertical Tray.

CCTV control cables shall be a composite cable consisting of one RG59 coax video cable and an appropriate number and size of copper conductors to meet the needs of the camera. Design-Build Contractor shall coordinate with the camera manufacturer to ensure proper connectivity.

Construction Requirements

Design-Build Contractor shall coordinate the cable installation as required to suit field conditions in accordance with the manufacturer's instructions and as approved by INDOT. All materials shall be installed in a neat and professional manner. All installation services shall comply with all warranty provisions and warranty contract maintenance services. Cables shall be a suitable length to allow installation between equipment without exceeding the minimum bend radius as specified by the manufacturer. Connectors shall be installed as necessary, and shall match the connector interface requirements for the equipment being connected. Adapters are not acceptable.

ARIES Field Processor

Description

The AFP is an interfacing device installed in the cabinet or other enclosure to perform as a terminal server. It provides software-based digital video encoding/decoding for video transmission from field CCTV camera to the applicable TMC and transfer PTZ control commands from TMC to camera site. In addition, AFP has options to provide interface between TMC network and all field devices such as DMS, and field processing of vehicle detectors such as microwave and microloop.

Materials

The AFP products have been chosen as main component in TMC. Refer to INDOT-approved materials list for material details.

The contact information is as follows:

Mr. Richard Anderson
Iron Mountain Systems, Inc.
31540 Pio Pico Road
Temecula, CA 92592
Telephone: (951) 491-0153
Fax: (951) 491-0193
Email: randerson@imsmail.org

Construction Requirements

Design-Build Contractor shall install all AFPs in the cabinets and connect them to the network. Design-Build Contractor shall provide environmental testing results, bench testing results, and field test results per NTCIP and Department standards. The AFPs shall be installed in accordance with the manufacturer's instructions. All materials shall be installed in a neat and professional manner. All installation services shall comply with all warranty provisions and warranty contract maintenance services.

Camera Tower, Foundations, and Concrete Paving

Description

This Work shall consist of designing, furnishing, and erecting self-supporting camera towers, including the tower foundations and the concrete tower pad, for the type and height specified herein. All Work shall be accomplished in accordance with the PPA Documents including the Technical Provisions, Section 711 , and any other applicable sections of INDOT Standard Specifications, including 701, 702, and 703. The tower shall be supplied complete with all parts, fittings, and foundations; completely erected; lighted (as required); painted (as required); and ready for use by INDOT. Design-Build Contractor shall comply with all applicable Federal and Indiana Occupational Safety and Health Agencies (OSHA) regulations for this type of structure.

The towers will be used to support CCTV and microwave detectors for expressway surveillance along the Project ROW. The towers are located along I-65 Mainline. Camera towers shall be designed in accordance with the design data detailed below. Design-Build Contractor shall provide INDOT with structural designs and engineering Design Documents signed and sealed by a registered professional engineer in the State of Indiana for the camera towers, including the tower foundations. Included in the design of the foundations shall be a Geotechnical Design Report where the Design-Build Contractor is required to drill at least one structural boring at each foundation and provide a report signed and sealed by a registered geotechnical engineer in the State of Indiana with foundation recommendations. The design of the foundations shall be in accordance with the Project Standards. Basic tower components shall include the following:

1. Concrete base, piers, and foundation
2. Stone base
3. Structural members
4. Conduit(s), cables, cable supports, NEMA 34 enclosure and winch drive enclosures per design schedules

Transmission line ladder and hangers

Lightning rod and grounding cable

Grounding system

5. Safety climb devices – horizontal members, welded climbing loops,
6. ladder, or bolt-type climb pegs for climbing and stainless steel cable type safety climb system
7.

Trolley with removable traveler

8.

Tower-mounted camera cabinets as required by this Project

9. The design shall comply with ANSI/EIA/TIA 222-G specifications.

10. The tower shall have a straight face design, such that the face width is uniform from the base to the top of the tower. The size of the steel rods shall be the only difference between successive tower sections.

During the construction and erection process and until completion of the tower, it is to be understood that all liability, either property damage or personal injury, connected with this project shall be the direct responsibility of the Design-Build Contractor.

The Design-Build Contractor shall warranty the complete tower against structural failure due to defective material or improper design or installation for a period of five years from the accepted completion date. This warranty shall include rust or any other mechanical defect in the tower, footings or anchors that would affect the normal life of the tower.

Design Data

The design criteria for camera towers shall conform to the EIA Bulletin ANSI/EIA/TIA-222-G or the latest edition.

Each tower shall be designed per American National Standards Institute/Electronic Industries Alliance/Telecommunications Industry Association (ANSI/EIA/TIA) -222-G structure class 2 and exposure class C. The ANSI/EIA/TIA-222-G topographic feature shall be designed per the most conservative topographic feature. The topographic feature for the towers shall be based on the latitude and longitude of each tower. The total load specified shall be applied to the structure in the direction that will cause the maximum stress in the various members.

The dead weight of the structure and all materials attached thereto shall be considered in the design.

The tower and footings shall be designed and constructed to maintain tower twist or sway limits as specified in EIA Bulletin ANSI/EIA/TIA-222-G or the latest edition. The twist and sway limits shall conform to a 90-mile-per-hour wind with no ice load. Design-Build Contractor shall verify with the manufacturer that specifications for selected antennas do not conflict with the tower deflection specification.

The tower shall support beacon(s), sidelights, and lighting equipment in accordance with the Federal Aviation Administration (FAA) requirements for each site.

An integral climbing device shall be furnished for the full length of the tower. The device steps shall be evenly spaced no further than 18 inches apart. This device shall be compatible with the safety climbing equipment described herein. The climbing device shall be part of the tower, not an external structure attached to the tower. The climbing device shall include a stainless steel cable climb safety device for the full length of the tower. The climb safety device shall use stainless steel mounting hardware. A solid climbing ladder may be considered as an alternate bid if an integral device is not available from the tower vendor. All applicable federal and Indiana OSHA regulations for climbing devices shall be complied with.

Towers shall be designed to incorporate an integral cable support system, enabling the use of snap-in hangers such as Andrew type 206706 snap-in cable support hanger.

Plans and Marking

Complete Plans and working drawings shall be supplied showing all of the necessary details to permit proper installation. All drawings shall show the tower and its equipment as it is to be constructed and approved by the Department.

Plans are to include the tower base and anchors, concrete tower foundation, cubic yards of concrete, concrete finishing techniques, tower section details, torque stabilizer details, hardware, parts lists, and electrical wiring data.

All steel, except hardware, shall be marked with stenciled markings on metal tags wired to the members. The markings shall have a height of not less than 5/8 of an inch. The markings shall correspond with the markings on the manufacturer’s erection diagrams (assembly drawings).

Materials

Solid steel rod members shall be used for tower construction to reduce drag coefficients, minimize wind and ice loading and high-corrosion resistance properties. In-factory welded construction shall be used as practical for easy in-field installation. Solid steel rod members shall be factory-painted as required or treated for corrosion protection in the factory.

All towers shall be labeled with a unique identification tag. The tag shall identify the manufacturer. In addition to the tower requirements above, the following items are required for specific tower locations, as referenced below. Design-Build Contractor shall provide a written certification that the manufacturer has designed the self-supporting tower and foundations in accordance with EIA/TIA standards. A Registered Professional Engineer in the State of Indiana shall stamp the tower and foundation designs. Design Documents shall be submitted in accordance with Design Quality Assurance, Quality Control and Oversight standards. Structural steel, cast steel, and steel forgings and bolts shall conform to specifications listed in "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," issued by the American Institute of Steel Construction

(AISC), latest edition. Bolts and locking devices furnished shall be of high-strength steel and shall conform to the AISC specifications.

Steel tubes and/or pipe shall not be acceptable as construction material for this tower. Tower design shall include the following basic criteria:

1. Self-supporting lattice tower structure with triangular base. Camera towers shall have straight vertical legs to the top.

2. Solid steel rod members (i.e., no hollow components that can trap water).

3. Tower codes per current EIA/TIA standards.

4. Camera Tower Loading:

   a. Two cameras (maximum of one camera per tower face).

   b. Two cameras with lowering systems (maximum of one (1) per tower face). Camera lowering arms shall be designed at 70 feet from the base of the tower, with a maximum total equipment dead load of 600 pounds per camera.

   c. Two 4-foot parabolic antennas (designed such that, regardless of tower height, the tower will be able to support the antennas mounted 2 feet from the top of a 120-foot tower to accommodate future expansion of towers less than 120 feet in height).

   d. Two 30-inch by 30-inch by 48-inch tower-mounted camera cabinets mounted 5 feet above the base of the tower (conduit and 0.5-inch antenna cabling as necessary).

For friction-type connections, all high-strength bolts shall be installed in accordance with American Institute of Steel Construction (AISC) publication "Specifications for Structural Joints Using ASTM A325 or A490 Bolts," latest edition. All bolts shall require a nut locking device.

Solid steel members shall be used for tower construction to provide high-corrosion-resistance properties. In-factory welded construction shall be used for easy in-field installation. Solid steel members shall be factory primed and painted as required or treated for corrosion protection in the factory. All cotter pins used shall be made of a high-quality stainless steel to ensure long life. No substitutes shall be accepted.

Leveling of the tower at the base shall be done using only a steel plate of a suitable area and thickness.

All towers shall be labeled with a unique identification tag. The tag shall identify the manufacturer and shall include the tower identification address used in the Design Documents.

Manufacture and Workmanship

All manufacturing and workmanship shall be in accordance with commonly accepted standards of the structural steel fabricating industry.

All welding procedures shall be in accordance with the requirements of the appropriate AISC or AISI specifications.

Galvanizing Process

All steel material shall be galvanized after fabrication as described in the Electronics Institute Alliance (EIA) Bulletin ANSI/EIA/TIA-222-G or the latest edition as of the Setting Date.

Safety Climb System

A 3/8-inch, minimum, safety climb stainless steel cable system shall be installed on the tower, which meets EIA/TIA-222-G and OSHA-approved safety climb system standards, latest edition. A "trolley" attachment device or safety sleeve (a device that safely attaches to the safety cable with an emergency brake) with all necessary hardware and safety devices shall be furnished by Design-Build Contractor. The system shall include a removable traveler as well as all end-sleeves, connections, and standoffs (if Design-Build Contractor's proposed system is compatible with the Rohn Safety Climb). The climb safety system shall extend above the top of the tower, a minimum of 3 feet, to allow for continuous attachment of the climber while inspecting or performing maintenance on the top beacon light assembly.

If a rail system is used in lieu of a cable system, there shall not be a significant void or gap between sections of the rail to allow the trolley to fall out of the rail track or be hung up at the gaps or voids.

Foundation and Anchors

Pad and stem foundations and anchors shall be designed, taking into consideration the actual soil pressure from the geotechnical report for this specific site. The design shall take into account the resultant of all dead- and live-load reactions. Foundations and anchors shall be designed for the maximum combined dead and live loading expected.

In uplift, it shall be assumed that the base of the standard foundations or anchors with an undercut or toe engages the frustum of an inverted pyramid or cone of earth whose sides form an angle of 30 degrees with the vertical. Earth shall be considered to weigh 120 pounds per cubic foot (unless the soil analysis report dictates otherwise) and concrete 150 pounds per cubic foot. Weights of other materials shall be considered at the established values. The weight of all materials used to resist the uplift shall be calculated, and 50 percent of the actual value is added in order to provide a minimum safety factor of 2.

Foundation plans shall ordinarily show standard foundations and anchors as defined in this section. Where some modifications of the Project Standards are necessary because soil conditions are not normal, the manufacturer shall furnish a foundation design and Plan based on the actual soil conditions.

The concrete strength shall be in accordance with ASTM C94 and ACI 318 (latest edition) and shall test 4,000 pounds per square inch minimum in 28 days. Reinforcing bars shall be of intermediate grade 60 and in accordance with ASTM-A-615. All exposed concrete surfaces not formed shall be chamfered. Concrete tests shall be in accordance with ACI 301. Test two cylinders at the age of seven days and two cylinders at the age of 28 days. Reserve one cylinder for 56 days if the 28-day test does not meet the requirements. Three copies of the concrete test results, in report form, shall be supplied to INDOT.

Erection of the tower may begin 14 days after the concrete has been poured, provided the concrete test results are acceptable.

The tower base shall be carefully formed and poured so that the portion above grade level will present a neat and finished appearance. At least 6 inches of the base shall be above the final grade level. This base shall contain adequate reinforcing bars, neatly spaced, to provide adequate strength within the dictates of good engineering practices.

Construction Requirements

Prior to installation, Design-Build Contractor shall verify with INDOT the exact location, coordinates, and orientation of the CCTV camera before the placing of the foundations. The top of foundation for each tower shall be placed at the elevation indicated on the Plans. The tower orientation typically will permit mounting of the camera lowering system perpendicular to the mainline travel lanes such that it does not conflict with the microwave detector installation.

Grounding connections shall be made as soon as the first section is installed.

Concrete Paving

Design-Build Contractor shall pave the interior of the fenced area with 6 inches of non-reinforced Portland cement concrete (PCC). Paving shall be slightly sloped to drain water away from shelter. The cost of this PCC pavement shall be incidental to the tower construction and shall be included in the cost of the tower.

Site Preparation

Design-Build Contractor shall provide a staked layout of the tower base and anchors, for the review and approval by INDOT three days prior to construction.

Design-Build Contractor shall be responsible for field adjustments of the tower location, including foundation and anchors. Any alteration to the locations on the Plans shall be submitted to INDOT for approval. Design-Build Contractor shall document changes on the Plans and submit revisions to INDOT.

Care shall be taken by Design-Build Contractor to preserve the lawn area around the tower construction area to the extent possible to minimize lawn restoration. Design-Build Contractor shall restore the grounds to their original condition. Upon completion and before the final inspection, all debris from the construction shall be removed and the site left in a neat and presentable manner.

Drilled Shaft Submittals

If drilled shaft foundations are selected by Design-Build Contractor then Design-Build Contractor shall be in accordance with INDOT RSP 728-B-203.

Tower Site Access

Design-Build Contractor shall provide driveway access to sites in excess of 15 feet from the edge of shoulder. This access shall be in accordance with a modified Class II driveway, with 12 inches of #53 stone, and appropriate pipe and end sections per the IDM.

Fence and Gate for Tower Sites

Description

This Work shall consist of installing a barbed wire fence around the field tower sites and a gate for access into the fenced area.

Material and Construction Requirements

Fencing surrounding the field tower, including the barbed wire and gate shall be installed in accordance with 603. The fence height shall be minimum six feet and gate shall be sized to accommodate the largest equipment or vehicle requiring access. Gates shall be supplied with a gate latch capable of being padlocked when in the closed position. One padlock shall be provided per gate. Padlocks are to be as described elsewhere in these provisions. The fence, barbed wire, and gate shall be grounded according to these provisions. Gates shall be positively grounded to the grounding system.

Grounding Assembly

Description

This work shall consist of furnishing, assembling, and installing a grounding system as shown on the Plans and in accordance with these provisions and Motorola Standards and Guidelines for Communications Sites 2000 (R-56). Design-Build Contractor shall use a Registered Professional Engineer in the state of Indiana experienced in ground system design to design the grounding assembly and ensure that it is compatible with the site's ground system. Proof of such shall be submitted with the Final Design Documents in the form of a design drawing sealed by a Registered Professional Engineer in the state of Indiana. The ground system of each site shall achieve a resistance to earth of 4 Ohms or less, verified by three-point/fall-of-potential testing. An instrument designed specifically to measure the resistance of a point to each ground shall be used, and the instructions provided with the instrument shall be followed for proper measurement method. All measurements shall be recorded along with the location of each ground rod and submitted to INDOT.

Materials

The grounding assembly includes all items and incidentals necessary to successfully ground the tower sites, the surrounding chain-link fence, communication shelter, ITS equipment cabinets, generators, and panel boards as shown on the Plans.

Ground rods shall be copper-clad steel or solid copper as approved by INDOT. The rods shall have a minimum length of 10 feet and minimum diameter of 5/8 inch or greater, as otherwise required by National Fire Protection Act (NFPA) 70, Article 250-52. The actual diameter (greater than minimum diameter), length (greater than minimum length), and number of rods required may vary with site dimensions and/or as determined by an engineering study based on the soil resistivity profile and soil pH of the site. Electrolytic ground rods maybe used, if required by soil conditions, with the approval of INDOT. Refer to "Soil Resistivity Measurements" NFPA 70, Article 250-52, and NFPA 780, Section 3-13, for more information. The method of bonding grounding conductors to ground rods shall be compatible with the types of metals being bonded.

General

Ground rods shall be buried to a minimum depth of 30 inches below finished grade, where possible, or buried below the freeze line, whichever depth is greater. Where practical, ground rods shall be buried below permanent moisture level (NFPA 70, Article 250-52). Ground rods that cannot be driven straight down due to contact with rock formations may be driven at an oblique angle of not greater than 45 degrees from the vertical, or may be buried horizontally and perpendicular to the building, in a trench at least 30 inches deep. Refer to NFPA 70, Article 250-52 and NFPA 780, Section 3-13.1.5 for more information.

Ground rods shall not be installed more than 20 feet apart (or twice the length of the rod) and not less than 6 feet apart, per NFPA 70, Article 250-56.

The method of bonding grounding conductors to ground rods shall be compatible with the types of metals being bonded. Ground rods shall be free of paint or other nonconductive coatings. See NFPA 70, Article 250-52 and NFPA 780, Section 3-13.1.

All grounding conductors outside of the communication shelters shall be bare tinned solid #2/ AWG copper wire or as shown on the Plans and shall meet the size requirements of NFPA 70, Article 250-66. Solid wire is required below grade to prolong longevity. For areas highly prone to lightning and/or areas with highly acidic soil, larger conductors shall be used, per Motorola R-56. Solid straps or bars may be used as long as the cross-sectional area equals or exceeds that of the specified grounding conductor.

Tower Grounding

A ground ring containing at least three equally spaced ground rods shall encircle the tower. The ground rod spacing shall not exceed 20 feet for 10-foot ground rods. The tower ground ring shall have a minimum diameter of 18 feet.

Self-supporting towers exceeding 5 feet in base width shall have at least four ground rods (ANSI T1.313-1997 and ANSI/EIA/TIA-222f). The ground rod spacing shall not exceed 20 feet for 10-foot ground rods. The tower ground ring shall have a minimum diameter of 23 feet.

Each leg of the towers shall be bonded to the tower ground ring using grounding conductors of #2 AWG minimum, bare tinned solid copper conductor. The vertical wire from the tower leg to the ring shall be insulated from earth contact for the first 12 inches or more by passing it through a polyvinyl chloride (PVC) pipe. This is to reduce the step voltage in the immediate vicinity of the tower.

In addition, a top-mounted lightning rod, extending above the topmost appurtenance, connected to a full tower length "down conductor" grounding cable shall be installed to provide a non-destructive path to ground for lightning contact with the tower structure. The down conductor shall consist of a #2 stranded copper cable attached and exothermically bonded to the uppermost tip of one tower leg, extending downward in a continuous run, exothermically bonded to the lower end of the same leg, then exothermically bonded to the grounding ring at the tower base. The down conductor shall be securely fastened, using two wraps of stainless steel banding, to the tower leg on which it is installed to prevent movement. The lightning rod shall be

bonded to this down conductor. The tower ground bus bars shall be bonded to the "down conductor."

Construction Requirements

All tower grounding Work shall be coordinated with the tower erection, fence construction, and other electrical Work associated with energizing the panel board within the communication shelter. All electrical components installed on the tower shall be electrically connected to the grounding system, including the PTZ mechanisms, cameras, and cable shielding. All construction and testing work shall conform to National Electrical Code (NEC) requirements, as well as these provisions. Design-Build Contractor shall provide INDOT with all test data and results.

The pH (hydrogen ion concentration) of the soil where a grounding electrode system is to be installed shall be tested before the system is installed. Acidic soils (pH below 7) can have a destructive effect on copper and other metals. In strongly acidic soils (pH of 5 or below), an electrolytic ground rod system shall be installed to maintain the life expectancy of the system. The electrolytic ground rod system shall be by Harger or an equivalent.

The following requirements apply when installing grounding conductors:

Grounding conductors shall be run as short, straight, and smoothly as possible, with the fewest possible number of bends and curves. Refer to NFPA 70, Articles 800-40, 810-21, and 820-40.

A minimum bending radius of 8 inches shall be maintained, applicable to grounding conductors of all sizes, per NFPA 780, Section 3-9.5 and ANSI T1.313-1997. A diagonal run is preferable to a bend even though it does not follow the contour or run parallel to the supporting structure. All bends, curves, and connections shall be toward the ground location, rod, or ground bar (grounded end) of the conductor.

Grounding conductors attached to the tower, communication shelter, and above-ground structures, especially copper straps, are exposed to movement by wind and other physical forces that can lead to damage or breakage over time. The following requirements shall apply when installing grounding conductors on these structures:

1. The grounding conductor or its enclosure shall be securely fastened to the surface on which it is carried.
2. Grounding conductors shall be attached using the method recommended by the equipment manufacturer.
3. The fasteners shall not be subject to breakage and shall be of the same material as the conductor or of a material equally resistant to corrosion as that of the conductor.
4. Approved bonding techniques shall be observed for the connection of dissimilar metals.
5. Grounding conductors shall be securely fastened at intervals not exceeding 3 feet. Refer to NFPA 70, Articles 250-64(b), 810-21(c), and NFPA 780, Section 3-10.

All earthwork preparation and grading necessary for installation of the tower grounding system will be considered incidental to this Work. When the installation is completed, all disturbed portions of the construction area will be cleaned, and any excess excavation or other materials shall be disposed of in a timely manner. All final cleanup will also be considered incidental to this Work.

Lightning Protection

Description

Lightning protection shall include all devices necessary to provide safety for the equipment, cabinets, and service personnel by preventing damage caused by lightning. All poles and towers that are connected to an external power source (i.e., non-solar) and that exceed 15 feet in height shall be equipped with appropriate lightning protection. All ground wires shall be tinned copper.

Design-Build Contractor shall design a lightning protection system for each tower site and submit Plans in the form of a design drawing for approval by INDOT. The design shall be stamped by a Registered Professional Engineer in the state of Indiana. Submitted lighting protection plans must include a scaled tower site elevation view that shows all elements within the zone-of-protection provided by the lightning protection installed on the tower.

The system shall be an effective, aesthetically acceptable by INDOT, streamer-delaying lightning protection system designed to the standards of UL96 and UL96A. The system shall be designed in such a manner that it affords protection to the structure upon which it is installed in the event a direct lightning strike to the structure does occur. The system shall require no external power and shall require no extraordinary maintenance.

The following contain requirements that relate to this section:

1. Underwriters Laboratories, Inc., Lightning Protection Components, UL 96 and UL 96A
2. NFPA, Standard for the Installation of Lightning Protection Systems, NFPA 780
3. Motorola R-56, Motorola Standards and Guidelines for Communications Sites 2000, Chapter 6, External Grounding.

Where conflicts exist between the above-referenced documents and this document, the more stringent requirement shall prevail.

Materials

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include Alltec Corporation, in Canton, North Carolina; Lightning Masters Corporation, in Clearwater, Florida; or East Coast Lightning Equipment, Inc., in Winsted, Connecticut.

The lightning protection system shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment and shall be the manufacturer’s latest approved design. The manufacturer shall have a proven track record of successful lightning

protection system performance. The equipment shall be UL listed and properly UL labeled.

The manufacturer or its authorized representative shall provide product and technical support.

All equipment shall be new and of a design and construction to suit the application where it is used in accordance with accepted industry standards and UL and NFPA requirements.

All lightning protection materials and components shall comply in weight, size, and composition with UL96 and NFPA780 lightning protection material requirements for the structure being protected. Components shall be constructed of material as specified by UL96 and UL96A for a system employing copper components, unless otherwise directed by INDOT or as necessary to prevent dissimilar metals from coming into contact. Class II materials shall be used on throughout the system.

Construction Requirements

Installation shall be accomplished by an experienced installation company that is listed with UL for lightning protection installation.

If installed on a metallic or an otherwise electrically conductive structure, the system shall be electrically bonded to the structure upon which it is installed through its mounting clamps and brackets, with additional bonding jumpers to grounded objects and to the structure, as required.

Design-Build Contractor shall coordinate its Work in such a manner as to not interfere with the normal operation of the structure upon which the installation is performed. Design-Build Contractor shall ensure a sound bond to the grounding system.

SIGNS

Dynamic Message Signs

The DMS shall meet the Project Standards by Department (refer to *Traffic Management Strategic Deployment Plan, Final Report, Indiana Department of Transportation, 2008*) for the signs located on this Project. All overhead DMSs shall be mounted perpendicular to and centered over the travel lanes for the best line of sight. Design-Build Contractor shall design the DMS installations to meet the pertinent state standards, MUTCD standards, on DMS controller and communications, maintenance with safe access, and operation on 24/7 schedules.

The overhead DMSs are LED (light emitting diode) displayed, full-matrix signs capable of displaying three lines of up to 21 characters each, with support structures and foundations in accordance with the AASHTO standards and pertinent State standards for DMSs.

The sign display shall have a minimum width of 127 pixels and a minimum height of 27 pixels.

Design-Build Contractor shall be fully responsible for design, structural calculations, fabrication, the installation of the DMSs, and sign structure and supporting foundations. Design-Build Contractor shall be responsible for the design, furnishing and installation of maintenance platforms, guide railings, or traffic barriers if within clear zones, as required by OSHA, Department TMC. Design-Build Contractor shall be responsible for all testing of DMSs, per NTCIP standards, to provide a fully functional DMS subsystem.

Design-Build Contractor shall furnish and install a permanent DMS mounted on a new structure. This Work will be done in accordance with Project Standards, except as modified herein. The sign messages shall be initiated by the advanced traffic management system (ATMS) software, or by a portable field control computer at the sign site for local diagnostics. Commands from the ATMS software shall be transmitted over Department communications infrastructure or a standard cellular connection using a wireless modem and service. Cellular communication is allowable for temporary communications. However, fiber communication is required as a final condition. All DMS equipment shall be housed within the sign housing; no external cabinets will be used. The DMS shall be NTCIP compliant as currently defined by the NTCIP *Object Definitions for Dynamic Message Signs Publication 1203* (including subsequent revisions).

Description

This Work shall consist of furnishing and installing a permanent DMS, complete with all components as shown on the Plans and as described herein.

1. The DMS shall be a full matrix LED sign with a walk-in enclosure housing using all modular, controller, electrical, and communication equipment. The DMS shall include the following basic components:
2.
3.

DMS

Walk-in enclosure

DMS controller, firmware, and software

Electrical end-equipment

Mounting hardware

Overhead DMS Box Truss, per Department Standard Drawings

General Requirements

The Design-Build Contractor shall furnish, install, and test all equipment and components necessary to provide full and complete ITS functionality in all respects, without additional expense to INDOT.

The Design-Build Contractor shall furnish one controller as an integral part of each DMS. The controller is to be mounted inside the DMS and connected to the AFP (provided by Design-Build Contractor) for communications back to the TMC.

The Design-Build Contractor shall demonstrate that the DMS functions and meets the requirements in these specifications.

The Design-Build Contractor shall provide all equipment required for testing of the DMS and DMS components included as part of the Work as an appurtenance to the electronic equipment included within this Project at no additional expense to INDOT.

National Transportation Communication for ITS Protocol Standards

NTCIP Definitions

NTCIP	Definition Terms
DMS	A DMS includes the sign display, controller, housing, and other associated field equipment. NTCIP standards (defined in two distinct sub-requirements, as below): If the access of the object is read-write, a management system shall be able to set the object to any valid value as defined by the syntax and description fields (except that the value of "other" need not be supported when such a value is defined) and the indicated functionality shall be provided. The value indicated by the object (e.g., in response to a "get"), regardless of the access, shall reflect the current condition per the rules specified in the object's description.
Management System	A computer system used to control a DMS. This includes any laptop software used for field control as well as the central control software.
NTCIP Component	A DMS or a management system
NTCIP System	A management system, plus the various DMSs controlled by the management system

Dynamic Message Sign Manufacturing and Design Standards

DMS manufacturers shall comply with the Project Standards including the most current version, as of the Setting Date, of the following standards:

High-voltage wiring: High-voltage components and circuits (120 volts alternating current) shall be wired and color-coded per the NEC.

1. Environmental: The display and all display components shall conform to NEMA TS-2 Section 2 Environmental Standards.

2. Shock/Vibration: The display and all display components shall conform to NEMA TS-2 Section 2 shock/vibration tests.

3. NTCIP: Refer to NTCIP Section.

4. NEMA TS 4 Hardware Standards for DMS with NTCIP Requirements.

Materials

5. All electrical equipment shall operate within the range of environmental conditions specified herein and come with warranties. The warranties shall receive the approval of INDOT prior to the use of the respective equipment.

Weight and Dimensions

The maximum static weight of the DMS, including all internal and external components and mounting devices and members shall not exceed 4,500 pounds. In addition to the static weight, a live load of 600 pounds for maintenance personnel and equipment is to be accounted for in the structural analysis. The approximate outside dimension of the DMS enclosure shall not exceed 28 feet wide by 9 feet 10 inches high by 4 feet 1 inch deep.

Display Characteristics

The DMS shall consist of interchangeable LED modules arranged to provide a full matrix display. The full matrix display shall provide three character lines each 20 characters long, separated vertically by three blank pixel rows. Horizontal spacing between characters shall be a minimum of one pixel column. Each display module shall consist of one or more pixel matrices. Each pixel matrix shall form characters that are 18 inches in height.

The sign display shall have a minimum width of 127 pixels and a minimum height of 27 pixels.

The width of the borders on the display shall be equal and not less than 12 inches. Legibility of displays shall include daylight hours with direct sunlight on the face and behind the DMS.

Minimum clear visibility and legibility distance for the sign shall be 900 feet at an eye height of 3.5 feet within a 10° cone of vision about the optical axis under all weather conditions, except heavy rain, fog, or snow.

The display shall not perceivably brighten due to stray headlights shining on the photocells at night.

1. **Basic Dynamic Message Sign Functions**

A character set shall be provided and shall consist of at least the following:

All 26 capital letters of the alphabet

All digits 0 through 9

Arrows pointing to the eight primary compass points

2. Punctuation marks ($ + - = . , ' & / \ ( ) * ! ; : " ” % # ? < > @ ~ ^ [ ] |)

3. Sequential arrow

4. Standard font (7x5 pixels per character)

5. Double stroke font (7x7 pixels per character)

6. Condensed font (7x4 pixels per character)

7. Expanded font (7x6 pixels per character)

8. Two additional user-defined fonts for a total of six fonts (standard, double stroke, condensed, expanded, two user defined)

9. Each sign shall be able to display static, multi-frame, or flashing messages:

10.

1. Static Message: The chosen message shall be displayed constantly on the sign face until the sign controller is instructed to do otherwise.

2. Multi-frame Message: The chosen message shall display up to four different frames alternately at durations separately controllable in 0.1-second increments from 0.1 seconds to 25.5 seconds.

3. Flashing Message: A flashing capability shall be possible by blanking the LEDs. The parameters controlling the flashing rate shall be operator-selectable from 0.1 seconds to 9.9 seconds, in increments of 0.1 seconds.

Display Modules

The sign display shall be created by interconnecting several individual and interchangeable display modules. Each display module shall be capable of displaying a minimum of one 18-inch character, but not more than three 18-inch characters. The replacement of a complete display module shall be possible from the interior of the sign enclosure without the use of any special tools. Display modules shall be identical and interchangeable in all signs provided for this Project. Interconnection of modules shall be through connectors only. Each pixel shall have its optic axis oriented perpendicular to the sign face. Pixels shall be attached to the display module with a secure fastening system.

Pixels

Pixel columns and rows shall be perpendicular. The horizontal and vertical spacing (the pitch) of the pixels on center shall be identical on each display module and between all display modules in the DMS.

Each pixel shall contain either one or two strings of LEDs. Pixels containing only one string shall have a minimum of six LEDs and be designed such that the failure of one LED shall not affect the operation of the rest of that string or any other string. Pixels containing two strings shall

contain a minimum of three LEDs per string and be designed such that the failure of an LED in one string shall not affect the operation of any other string or pixel.

Each pixel shall have a total brightness of 40 candelas per pixel at 20 milliampere as the sum from all LEDs in each individual pixel. The total on-axis (0 degrees horizontal, 0 degrees vertical) luminance intensity of the sign will be a minimum of 8,000 candelas per square meter. All pixels shall have equal color and on-axis intensity. The method used to provide the brightness, equal color, and intensity shall be included in the shop drawing submittals and approved by INDOT. Pixel brightness shall be tested and documented by a third-party lab. This documentation shall be submitted to INDOT for approval prior to shipping the sign.

Each pixel shall have a device attached to the printed circuit board (PCB) to hold and protect the LEDs. These devices shall do the following:

Hold the LEDs to within 0.5 degrees of being perpendicular to the display modules.

Prevent the LEDs from being crushed or bent during handling.

1. The LEDs shall be protected such that there is no contact with
2. them when the display module is handled or dropped.

3. Protect the LEDs from damage when the display module is laid on the front surface (the side on which the LED lamps are located).

4. Be easily removable from the display module PCB without any specialized tools.

5. Not put any stress on the LEDs due to differentials of expansion and contraction between the device and the LEDs over the temperature range herein specified.

6.

7. Not become loose or fall off during handling or due to vibration.

8. Not block airflow over the leads of the LEDs.

9. Not block the light output of the LEDs at the required viewing angle.

Be black in color to maximize contrast.

LEDs

The LEDs shall be amber in color and manufactured by Avago Technologies, Nicha Corporation, Sander, Agilent, or Toshiba Corporation, and be of the same make and model and all traceable to the manufacturer. LEDs will have a 30-degree viewing angle. LEDs shall have a typical luminous intensity of 4.2 to 7.2 candelas per individual discrete LED when driven at 20 milliamperes. The light emitted by the LED display shall be an amber color, with a peak wavelength centered at approximately 590 nanometers +2 nanometers. LEDs in an individual sign will be from no more than two consecutive “bins” for either color or light intensity levels. The DMS manufacturer will perform the color/intensity sorting of individual LEDs, and they will be distributed consistently from pixel to pixel. The luminous

intensity of the highest- and lowest-appearing pixels will be measured, and the intensity ratio (L1/L2 where L1 > L2) between the two shall be less than 3:1. LEDs shall have no less than 50 percent of the normalized intensity at their respective 30 degree viewing angle.

Each LED shall be individually soldered to the boards. Each LED shall be mechanically inserted onto the appropriate LED matrix module and wave-soldered. A conformal coating shall then be applied to both sides of each PCB to provide moisture and mildew resistance. LEDs that are surface mounted or through-hole with standoffs will not be allowed.

LEDs shall be nominally rated for 100,000 hours of operation under field conditions, which shall include operating temperatures between 29.2 degrees Fahrenheit and 165.2 degrees Fahrenheit.

The brightness of each LED shall be measured in accordance with the International Lighting Commission (CIE) Test Method A, as described with the CIE 127-2007, Technical Report: Measurement of LEDs. The LED brightness and color bins that are used in each pixel shall be provided to INDOT for approval.

Certification shall be provided with the shop drawing submittals from the LED manufacturer that demonstrates the LEDs were tested and binned in accordance with CIE Test Method A. This certification shall be provided to INDOT prior to site delivery.

Optical Performance

Operating contrast values between 6 and 25 shall be demonstrated for each lighting condition given the following definitions:

Luminance =	The luminous intensity of the 35 pixels The area of the block containing the 35 pixels including the background
Daytime Contrast =	(Luminance On - Luminance Off)/Luminance Off
Where the ambient light is simulated by a solar source simulator placed 10 degrees off the horizontal axis in front of the sign when measured on-axis to the center of the sign face giving a luminance of 40,000 lux on the sign face.	

Electronics

All DMS electronics shall be solid state technology and, with the exception of the PCBs, shall be commercially available, easily accessible, replaceable, and removable using conventional electronic repair methods. Moving parts shall be minimized where practical. All electronic and electrical components used in the LED display or DMS controller or other digital control devices shall be UL or Electronic Testing Laboratories (ETL) listed. This includes power supplies, wiring, and wiring accessories. Copies of UL or ETL product cards shall be provided to INDOT prior to site delivery to document the listings. All data and low power connections will be accomplished via positive locking devices.

All workmanship shall comply with ANSI/IPC A-610D Class 2 titled, "Acceptability of Electronic Assemblies," and ANSI/IPC-7711/21B titled, "Rework Modification and Repair Electronic Assemblies."

All PCBs, except for the LED motherboard, power supply PCBs, and controller PCBs, shall be completely conformal coated with 0.010-inch minimum thickness silicone resin. The LED motherboard shall be completely conformal coated, except at the pixels on the front of the PCBs, with 0.010-inch minimum thickness silicone resin. The material used for the PCB coating shall meet the military specification MIL-I-46058C Type SR.

The LED pixels shall be directly driven using pulse width modulation (PWM) of the drive current to control the display intensity. This LED driver circuitry shall vary the current pulse width to achieve the proper display intensity levels for all ambient light conditions. The drive current pulse shall be modulated at a frequency high enough to provide flicker-free operation and a minimum of 200 brightness levels. The power supplies shall be designed such that one supply may fail and the sign display will still be supplied with sufficient power to run 100 percent of the pixels at 100 percent duty at 60 degrees Celsius. The power distribution system shall connect each display module to all power supplies and shall minimize voltage drop over the face of the sign. Multiplexing drive circuits shall not be used. The LED display manufacturer shall supply the schematic of the display to document the LED drive mode used.

The current provided at maximum brightness shall be easily adjustable between 15 milliampere and 30 milliampere in 1 percent increments. This adjustment will be altered occasionally over the life of the sign to offset the dimming of the LEDs as they age. LED brightness shall be controlled or adjusted in three ways: locally using the sign controller, remotely from the ATMS using the sign controller's serial communications port, and automatically via a closed-loop ambient light monitoring circuit. Once the LED brightness is set or adjusted, intensity shall not fluctuate or flicker due to sudden ambient light level changes caused by weather (i.e., moving cloud cover) or vehicle headlights. It is not necessary that maximum brightness be remotely controlled. Upon installation, Design-Build Contractor shall set the maximum brightness current to 20 milliampere.

The sign controller shall continuously measure all LED module power supply voltages. The sign controller shall provide these voltage readings to the ATMS or remote laptop when polled.

Maintenance

All DMS equipment components, modular assemblies, and other materials located in the DMS housing shall be removable, transportable, and capable of being installed by a single technician accessing the sign from inside the walk-in enclosure.

Miscellaneous Requirements

The presence of ambient magnetic or electromagnetic fields, including those created by any components of the DMS subsystem, shall not interfere with the performance of the signs.

The rated life of all components, except LEDs, fans, filters, and equipment not normally furnished with the DMS, shall be a minimum of 20 years under 24-hour-a-day operation.

Equipment and accessories shall be, essentially, the standard cataloged products and of the latest design of manufacturers regularly engaged in production of such equipment and accessories for at least five years.

Differential expansion of the sign enclosure, sign face, and the display panel shall not cause damage to any of the components.

Walk-In Enclosure

The DMS walk-in enclosure (housing) shall be furnished and installed in this Project and be designed integral to the DMS. The DMS housing, including its front-face panels, shall be a NEMA type 3R, as described in the latest edition of the NEMA Standards Publication 250. The bottom of the sign shall be horizontal, and all sides shall be vertical. The top shall slope to the rear to completely drain rainwater from the roof. Sign housings shall be constructed of aluminum alloy 3003-HI4 or 5052-H32, and shall not be less than 0.125 inches thick. Seams shall be continuously welded. Framing structural shapes shall be constructed of aluminum alloy 6061-T6 or 6063-T52. Non-corrosive materials shall be used where possible and corrosion protection shall be provided between dissimilar metals. Sign housings shall be cleaned and de-oxidized after welding.

To allow for the vacuum effect of the passage of large trucks, the sign face shall be designed for and shall withstand a negative (outward) pressure of 50 percent of the design inward wind pressure. Gasket material, where needed, shall be impervious to moisture, smog, and salt spray. If neoprene is used, the mating surface shall be covered with a silicon lubricant to prevent sticking to the mating metal surface.

The walk-in enclosure shall be designed such that the top of the display face (the surface that faces approaching traffic) is tilted 3 degrees toward traffic. The top plane of the housing shall be sloped 0.5 degrees toward the back of the housing. The rear plane of the housing shall remain vertical, and the interior walkway surface shall remain level (horizontal).

The manufacturer’s name, month, and year of manufacture shall appear on the inside of the DMS housing. No logos or names of manufacturers shall appear on the outside of the housing.

Painting

The front of the sign enclosure will be coated with a semi-gloss black polyvinylidene fluoride (PVDF) protective coating. This coating will be designed to have a minimum of 10-year color retention and chalk resistance. All finish coatings shall be resistant to chipping, impacts, weather, scuffs, corrosion, and bacteria for a minimum of 10 years. All other surfaces shall be left their natural finish or unfinished aluminum.

Environmental

The sign shall be constructed to present a clean, neat appearance, and the equipment located therein shall be protected from moisture, dust, dirt, and corrosion. Sign enclosures shall contain small weep holes for draining moisture that accumulates in the signs from condensation. Weep holes shall be designed to prevent the entrance of insects and shall have snap-in drain filter plug inserts. The filter plug inserts shall be replaceable.

Sign Attachment Members

The sign shall be attached to the sign structure with I-beams or Z-bar extrusions. The number of I-beams or Z-bars needed and the method of attaching the I-beams or Z-bars to the sign housing and sign structure shall be as required to conform to the Project Standards. The housing shall be designed to accommodate mounting on the rear vertical plane. All structural hardware and mounting bracket hardware will be stainless steel or galvanized high-strength steel and appropriately sized for the application. Mounting brackets will be attached to the DMS using direct-tension indicators to verify that mounting hardware is tightened with the proper amount of force. The attachment method shall be certified by a Registered Professional Engineer. The DMS shall be furnished with all required hardware for attachment to the sign structure. Alternative mounting methods will be considered, and Design-Build Contractor shall submit final mounting plans to INDOT for Design Review.

Lifting eyes or the equivalent shall be provided for moving and mounting signs. The DMS housing shall be designed such that the DMS can be shipped and temporarily stored without damage or undue stresses prior to installation on the overhead support structure.

Maintenance and Repair

Design and construct the walk-in housing so that all maintenance and repair is performed from within the DMS housing, with the exception of structural members and components thereof. The minimum clear distance from the interior rear wall of the DMS housing to the closest display components shall be 2 feet. This free space shall be maintained across the entire interior of the sign housing. Structural members shall be designed and positioned so as to not be an obstruction to free movement of maintenance technicians throughout the interior of the housing.

Include in the housing an internal incandescent lighting system of at least six fixtures to provide maintenance personnel with a minimum of 35 foot-candles of light measured at the floor, evenly distributed, provided by ceiling or top of wall mounted incandescent or compact fluorescent lights utilizing a cold-weather ballast within each sign housing. Locate two 3-circuit control switches inside the DMS housing for the lighting system, within easy reach from outside the DMS housing through the entryway. The sign housing and display panel shall be designed to be sufficiently "light tight," such that during night-time maintenance activities, no internal lighting shall be visible or distracting to motorists.

The DMS housing shall include a minimum of three 15 Amp, 120 volts alternating current duplex electrical outlets, with ground fault circuit interrupters, for use by maintenance personnel. The duplex outlets are to be mounted on the back wall of the DMS, distributed evenly within the housing. All power runs inside the housing shall be protected in intermediate metallic conduits attached to the inside of the sign case.

Interior Walkway

The interior of the walk-in enclosure shall provide a minimum clear width of 2 feet and a minimum clear height of 6 feet through the length of the walkway to allow maintenance personnel free movement and working space. The interior walkway of the DMS shall be non-slip and able to support a minimum of a 500-pound load per linear foot and will be constructed of

multiple removable panels. The walkway's top surface shall be free of obstructions that would present a tripping hazard to maintenance personnel.

Personnel Access

The DMS housing shall have two vertically hinged doors, one on each end of the sign. The DMS housing doors shall be rain-tight/dust-tight. Doorway openings shall be a minimum of 6.5 feet in height and a minimum of 2 feet in width. The doors shall use a Corbin Lock Number 2 and shall be furnished with a minimum of one number 2 key. The DMS doors shall open to the exterior of the DMS and have a stop to retain the door in its fully open position while workers are inside the sign.

The latching/locking mechanism shall include two handles: one on the interior of the housing such that a person with no key and no tools cannot become entrapped inside the housing and another on the exterior of the housing with a key lock.

Cable Access

Provide a cable entrance for AC power as described herein. Conduit shall enter the rear exterior wall (facing away from traffic) of the sign case through a 90-degree bend in the conduit. The attachment point between the conduit and sign case shall be sealed on both sides of the sign case with a neoprene gasket or other approved material such that no moisture, condensation, or light can penetrate the seal.

Attach two junction boxes to the interior wall of the sign case: one to receive the AC power and one the communications cables. The junction box for the communications cable shall be 6 inches by 6 inches by 2 inches and labeled on the outside "COMM." The junction box for the power cable shall be labeled on the outside "AC POWER." All entries and exits from the junction boxes will be made via conduit. Approximately 2 feet of cable slack shall be coiled in the junction boxes. Conduits leading from the junction boxes to the lighting panel and the AFP shall also be provided.

Sign Display Cover

The sign display cover is attached to the front of each sign case and is a weatherproof assembly that presents an unobstructed view of the sign display.

The DMS shop drawings submitted by Design-Build Contractor shall demonstrate the technique employed to minimize glare, reduce solar heat gain on the LEDs, and increase sign contrast in all ambient lighting conditions.

Compose the sign display cover of a series of clear-formed segments that, when placed side by side, form a complete face. Each display cover segment shall be of a size and weight that can easily be handled by maintenance personnel for replacement or cleaning. The sign display covers and display modules shall be constructed to allow all service operations from inside the sign case. The cover shall not be damaged by sign vibration or the positive and negative pressures resulting from changes in atmospheric conditions or the passing of large trucks.

This includes cleaning the outside of the window by tipping the modules and sign face inward. The removal of any combination of windows shall not alter the structural integrity of the sign case.

The clear lens panels shall be made of polycarbonate. Polycarbonate shall contain an ultraviolet (UV) light inhibitor, which protects the LED display matrix from the effects of UV light exposure and prevents premature aging of the polycarbonate itself. Polycarbonate sheets shall have the following characteristics:

1. Tensile Strength, Ultimate: 9,000 pounds per square inch
2. Tensile Strength, Yield: 9,300 pounds per square inch
3. Tensile Strain at Break: 125 percent
4. Tensile Modulus: 330,000 pounds per square inch
5. Flexural Modulus: 330,000 pounds per square inch
6. Impact Strength, Izod (1/8 inch, notched): 17 foot-pounds per inch of notch
7. Rockwell Hardness: M75, R118
8. Heat Deflection Temperature Under Load: 264 pounds per square inch at 270 degrees Fahrenheit and 66 pounds per square inch at 288 degrees Fahrenheit
9. Coefficient of Thermal Expansion: 3.9X10-5 in/in/F
10. Specific Heat: 0.30 British thermal unit per pound per degree Fahrenheit
11. Initial Light Transmittance: 85 percent minimum
12. Change in Light Transmittance, 5 years exposure in a southern latitude: less than 5 percent
13. Change in Yellowness Index, 5 years exposure in southern latitude: less than 5 percent

The display cover and all associated parts, such as fasteners, shall be captive so that they cannot fall to the roadway. The windows shall be dust-proof and shall not leak when sprayed with water from any angle by a garden hose at a pressure equivalent to rain in a 90-mile-per-hour wind. The window frame(s) shall have a continuous closed-cell neoprene gasket around the entire perimeter. Horizontal portions of the gasket shall be supported by a channel. The gasket shall be at least 1 inch wide and 0.375 inches thick. The mating surface of the gasket shall be treated with silicone lubricant so that it does not stick. The sign face display cover shall be designed to minimize bowing.

Heaters and Fans

Signs shall contain thermostatically controlled fans and electric heating elements to prevent condensation on the inside of the display windows. A humidistat and thermostat shall also be included to activate the fans and electric heaters at user-selectable settings to control temperature and humidity for the display window and sign case. The defogging system shall be capable of substantially removing condensation from a completely fogged window within five minutes.

Vented thermostatically controlled fans shall be used to circulate the air inside the enclosures for cooling. Cooling fans shall turn on when the internal DMS air temperature reaches 30 degrees Celsius. Fans shall keep the back side of the display modules below 60 degrees Celsius when the outdoor temperature is 40 degrees Celsius, the face of the sign is in full sun, and 50 percent of the pixels are illuminated, drawing 20 milliamperes of current. The ventilation system shall achieve this performance despite the failure of any single fan. The fans shall be installed so as to either "blow" air into or out of the sign case. Air inlets shall have louvers to keep out rain, rustproof screens to keep out insects, and replaceable 2-inch air filters to keep out dust. The filters shall be available from multiple manufacturers and shall be located to facilitate replacement. Exhaust vents shall be screened and have movable louvers that are closed when the fans are not running.

The LED modules and electric equipment shall be protected by a fail-safe, back-up fan control system in the event of an electronic fan control failure or shutdown of the DMS controller.

Heaters shall operate from a 240-volt, 60-hertz, single-phase AC power. Fans shall operate from 120-volt, 60-hertz, single-phase AC power.

Fire Extinguisher

Furnish and install a 5-pound standard BC powder fire extinguisher by the rear door. The fire extinguisher shall have squeeze grip operation. The fire extinguisher shall be supplied complete with a wall bracket and shall be mounted on the internal wall of the sign enclosure within easy reach of the door opening.

The fire extinguisher shall include positive on/off operation, pull-pin safety locks, a waterproof stainless steel gauge, and an anodized aluminum valve.

Interference

The dimming circuit and DMS power system shall have electrical devices installed to minimize radio frequency interference (RFI) noise generated by the DMS both on the power line and radiated by sign circuitry.

DMS Controller, Firmware, and Software

Furnish, test, and install a DMS controller, firmware, and software compatible with the communications protocol provided by INDOT, at each DMS site shown on the Plans. Furnish, test, and install the auxiliary equipment and wiring required to complete the system testing. The DMS shall be capable of receiving communications from the server located at one of Department's TMCs and displaying messages by illuminating the LEDs to form legible words and graphics. Provide all equipment and materials needed to interconnect and interface the controller to the sign, including cables and connectors. Provide controller software that is consistent with the operational requirements and communications protocols.

DMS controllers shall have the following features:

Communications Ports. The DMS controller shall be able to receive instructions from and provide information to the ATMS network. There will be ports available for both local and remote operation of the DMS.

The DMS sign controller shall contain a minimum of one 10/100Base-T Ethernet communication port. This port shall be available for optional use for communicating from the ATMS to the DMS sign controller when an Ethernet network is available. The Ethernet port shall have a standard RJ45 connector.

The DMS sign controller shall contain a minimum of two NTCIP-compatible RS-232 communications ports. These ports shall support multiple communication interfaces, including direct null-modem (for local laptop control), dial-up and leased-line modems, radio systems, cellular modems, and fiber-optic modems. The RS232 ports shall all have standard DB9M connectors.

Microprocessor. The DMS controller shall be a solid state microprocessor.

2. Internal Clock. The controller shall have an internal clock that will satisfy the following minimum requirements:

3. The internal clock shall obtain its timing reference either from a crystal or from the 60-hertz frequency of the power input line. For internal clocks obtaining its timing reference from the 60-hertz power line frequency, the timing reference shall be crystal controlled in the absence of AC power. In either case, the clock shall be accurate to within 15 seconds per month.

The internal clock shall have both permanent and changeable memory. The permanent memory shall be in the form of plug-in programmable read-only memory (PROM) integrated circuits. It shall contain the software for performing the required timing functions. The changeable memory shall be in the form of random access memory (RAM) integrated circuits with a lithium battery back-up that retains the data in memory for a minimum of one year following a power failure.

The changeable memory shall contain the current time in the form of year, month, day of month, hour of day, minute of hour, and second of minute.

The correct time shall be entered into changeable memory as a function of the year, month, day of month, hour of day, minute of hour, and second of minute. Hours of the day shall be entered in 24-hour (military) format.

The internal clock shall automatically compensate for leap years. The dates and times on which daylight-savings-time changes take place shall be user-programmable. The programming for daylight-savings-time changes shall be accomplished in such a manner that

4. reprogramming each year is not necessary. Once set, the internal clock shall automatically adjust the hour of the day for daylight-savings-time changes.

Stored Messages. The DMS controller shall be capable of storing a minimum of 100 messages in non-volatile memory, each message consisting of up to three phrases and each phrase consisting of up to three full lines of text.

Default Message. The DMS controller shall be designed to blank out the sign in the event of a power failure.

Message Speed. The LED display shall update instantaneously with no shifting, scrolling, or other visual disturbance apparent to the motorist.

14. Controller Failures and Loss of Power. In the event of a controller failure, any displayed message shall be blanked out. The controller's operating system shall reside in non-volatile memory and shall reinitialize automatically at power-up and run without operator intervention. In the event of power outage, the clock shall re-start with the correct time (e.g., GPS or crystal clock) on the restoration of power.

15.

16.

During the period of time that the controller is attempting to automatically recover from a controller failure, and until such time that the initialization process is complete, no messages shall be displayed on the sign.

17. Pixel Failures. The controller shall determine how many pixels are not turning on, how many pixels are not turning off, and the number of modules that have failed. This information shall be reported to the DMS controller.

18. LED Temperature Monitor. The sign controller shall monitor the temperature of the LED circuit board and shall reduce light output (DC forward current) when the temperature exceeds unacceptable thresholds. At least three temperature levels, set via the system interface, shall be supported, which will result in increasingly lower output to the LEDs. The sign controller shall perform an automatic sign shutdown when the temperature exceeds an absolute threshold. The sign controller shall use an analog to digital converter to capture the current LED temperature. Current temperature shall be reportable to the ATMS or portable computer via the sign controller interface. The temperature sensors shall be equally spaced to cover each end and the middle of the sign.

The DMS controller shall continuously measure all LED module power supply voltages and be able to report those voltages both locally and remotely to the ATMS.

Physical

The DMS controller and all of its associated equipment, cables, connectors, and materials shall be designed, constructed, and positioned so that all maintenance and repair is performed from inside the walk-in enclosure.

All DMS controller equipment, components, modular assemblies, and other materials located in the walk-in enclosure shall be removable, transportable, and installable by a single technician.

Provide space inside the walk-in enclosure for the installation of the AFP and junction boxes. The area provided for the installation of this auxiliary equipment shall clearly be shown in Design-Build Contractor's

submittal of the DMS shop drawings. Conduits shall be provided between the DMS controller and equipment racks to the AFP and cabinet interface panel as necessary for a neat and orderly installation of cables and connectors.

The DMS equipment, components, and housing shall be designed and constructed for ease of maintenance. A single technician shall be able to remove and replace any modular assembly under adverse conditions in under 15 minutes. All electronic subassemblies shall be accessible and easily replaced by using plug-in or connector-based subassemblies. Any required configuration jumpers shall be clearly marked.

DMS controller circuit breakers, fuses, switches, and indicators shall be readily visible inside the walk-in enclosure.

All assemblies and panels shall allow air circulation through the top and bottom, unless specifically called out otherwise. Assemblies shall be fabricated of 0.0625-inch-minimum-thickness aluminum or stainless steel sheet. The metal surface shall be treated with clear chromate.

Software

The application software shall be supplied for local operation of the DMS controller, and it shall be NTCIP compliant. Provide a licensing agreement that facilitates unlimited use within INDOT or authorized maintenance contracts. Provide software with the following minimum capabilities:

1. Verify, set, and change the time on the internal clock.
2. Verify, enter, change, and delete dates and times for daylight savings time changes.
3. View, enter new, edit existing, and delete entries in the event schedule.
4. Verify, enter, modify, and delete password protection codes.
5. Diagnostic routines capable of testing full sign operation.

1. Display tests shall include but not be limited to the following:
2. All pixels on
3. All pixels off
4. All pixels on and off alternately
5. Sequence through each column
6. Sequence through each row
7. Sequence through the entire character set
8. Display immediate messages on the DMS entered through the portable field control computer’s keyboard.

Mimic both diagnostic and operator-generated messages sent to the DMS display on the portable field control computer’s display in

pixel matrix format identical to that of the sign being controlled.

Operator selection of dimming levels.

Exerciser

9. The manufacturer shall supply two compiled, latest versions of the FHWA, NTCIP exerciser with the manufacturer's MIB. One copy shall be sent to Jessica Kruger, Indiana Department of Transportation, and one to the manufacturer's representative. .

Dimming System

The DMS controller shall incorporate a means of changing the lighting level provided by the LEDs automatically in response to ambient lighting conditions at each sign location as detected by the photocell system, and remotely in response to commands received from the software. A light sensing system shall be used to detect lighting conditions between ranges of 2 to 20,000 lux. Provide photoelectric cells integral to the DMS. These devices shall direct the DMS controller to modify the intensity of the light produced by the pixel elements. Locate the photoelectric cells such that they are easily accessible for maintenance. Seal photoelectric cells using twist-lock-type receptacles or other approved receptacles suitable for this application. Three replaceable photocells shall be located on the DMS enclosure and positioned to sense the ambient light on three axes of the DMS in such a manner to provide the information necessary to allow the controller to adjust the light levels of the DMS to maintain optimum visibility at sunrise, sunset, and other abnormal lighting conditions.

Provide all wiring and equipment necessary for the operation and interconnection of the photocell system and the light level output control circuit. Incorporate the light level output control circuit in the DMS controller. The circuit shall consist of solid state or other approved methods for control of the photoelectric system. The system shall provide a minimum of eight settings that are both locally and remotely settable.

Electrical End-Equipment

Design-Build Contractor shall establish electric service accounts in INDOT's name, as appropriate. Each DMS sign shall have a lighting panel mounted within the sign case.

Each circuit shall be over-current protected. Each circuit breaker shall be UL or ETL, or an approved equal, switching duty type. The service personnel lighting and convenience receptacle outlets shall be provided with ground fault interrupters.

Power supplies shall operate from 120- or 240-volts-alternating-current power. The LED displays shall be operated at low internal DC voltage not exceeding 24 volts direct current. Power supplies shall be solid state electronic switching regulated output. The display shall be powered with two or more supplies wired in a redundant parallel configuration such that the supplies provide equal amounts of current to the display. When a power supply fails, the remaining supplies shall be capable of providing sufficient power to the sign display (20 milliampere to every LED on the line when the air around the power supply is at 60 degrees Celsius) and electronics.

Power supplies shall operate from -30 degrees Celsius to +60 degrees Celsius. Power supplies shall be short-circuit protected by DC power off and shall reset automatically after 5 seconds of AC power off. Power supplies shall also be protected by a minimum overload allowance of 105 percent and have an efficiency rating of at least 75 percent. The power supply shall be UL or ETL listed. Power supplies may be mounted either above or below the interior walkway of the housing. Units mounted above shall not encroach on the 2-foot-wide, 6-foot-high clear space above the walkway. Units placed beneath the walkway shall be mounted above the bottom surface of the housing with a chair bracket to provide protection against water damage.

All signs shall be unaffected by surges or transient voltages normally experienced on commercial and industrial power lines. Signs will be protected from surges and transient voltages by the incorporation of metal-oxide varistor (MOV) devices at the AC line circuit input utilization of a multi-section L-C filter ahead of the sign electronics power supply. Protection against abnormally low and high voltages will be provided by an electronic voltage detection circuit controlling the AC input power with a suitably selected contact relay.

An AC line monitor shall be provided to monitor the AC signal entering the sign. If three consecutive positive pulses are not detected, the AC line monitor will relay a signal to the DMS controller indicating power has failed. The DMS controller will then send a signal to the drivers to blank the sign or display the default message.

All signs shall be equipped with lightning protection, including electrical service and telephone service, as appropriate. Protection from lightning shall include gas discharge devices followed by zener diodes for data entry connections to the sign. Proper grounding of the sign housing shall be the responsibility of Design-Build Contractor

Mounting Hardware

Mounting hardware shall be supplied with the DMS. The mounting hardware shall include those devices shown on the Plans and all other appurtenant hardware, connectors, bolts, structural stiffening members, etc., necessary to attach the DMS to the structural supports.

Construction Requirements

Installation

Upon delivery to a storage location or to the site of installation, place the DMS in a manufacturer-approved manner, including supports that keep the sign off the ground and in a stable position. Supply all mounting bracket and required hardware for the permanent mounting of the DMS. Supply bolts if the lifting eyebolts are removed from the DMS after installation, to plug and seal the holes to prevent water from entering the DMS housing. If the lifting bolts are to be removed, provide compatible lifting bolts to Department for possible future use.

DMS Testing and Acceptance Requirements

Conduct such tests as necessary to ensure each DMS meets the requirements and specifications. INDOT or Department Representative reserves the right to witness and verify, or to appoint a representative to witness, all product testing during manufacture of the DMS. If the FAT is performed at a location more than 100 miles from the Site, the Design-Build Contractor

shall reimburse travel costs for up to four Engineer or Department Representatives.

Factory Acceptance Testing (FAT)

The FAT shall be performed at the DMS vendor's manufacturing facility. FAT is required prior to shipping of any DMS and shall include the following, at a minimum:

Passage of the NEMA 250 Water Spray Test with no visible signs of water leakage through any of the sign housing seams.

Proof of the 48 hours of continuous operation of the FAT DMS at each of two test conditions: 25 degrees Fahrenheit (first test) and 125 degrees Fahrenheit (second test).

Post-FAT, INDOT will audit and approve all burn-in test logs for each DMS prior to that DMS shipping from the factory.

The physical verification through inspection by INDOT or INDOT Representative that the DMS meets the special provision and the approved submittal and shop drawings.

Post-Delivery Testing and Operation

Prior to delivery of the DMS, the site shall have all lightning and surge suppression and grounding and bonding performed and accepted. Upon the delivery of each DMS to the location designated by INDOT [determine if locations will be supplied in the RID] and as shown on the Plans, provide permanent power for demonstration of the DMS' functions in accordance with the requirements and specifications and for proof that the DMS has not been damaged during shipment. Maintain the DMS power feed from the day of delivery to Final Acceptance, thereby protecting the interior electronics within the DMS from environmental degradation.

Post-Delivery Test Plan

Develop and submit to INDOT a DMS Post-Delivery Test Plan with the working drawings. The test plan shall demonstrate the complete functionality and integrity of the DMS after shipment and post-delivery. The plan will describe test procedures, detail the features being tested, and the detail the expected values that demonstrate DMS compliance.

Testing Schedule

All DMSs will be tested in accordance with the INDOT-approved Post-Delivery Test Plan. Schedule and conduct the post-delivery tests at a time approved by INDOT.

Reporting Requirements

Submit vendor and third-party reports verifying testing procedures, testing dates, and testing results to INDOT. The report will document the comparison of test results to the specifications detailed herein. The report will clearly identify any failure to conform to the specifications.

Failure to conform to testing procedures will be considered a defect of the equipment, and will thereby be subject to rejection by INDOT. Rejected equipment may be offered again for a retest. The retest shall fully comply with the test procedure, and the DMS is retested by the vendor or third party. Evidence of conformance of the test shall be submitted to INDOT.

Failure of any DMS to conform to the Design Documents, Construction Documents, or the PPA Documents will be considered a Defect, and the DMS is thereby subject to rejection by INDOT. Rejected equipment may be offered again for a retest, provided that all nonconformances have been corrected and retested by the vendor and evidence thereof has been submitted to INDOT.

Final FAT and product test reports showing complete compliance with specifications shall be submitted for review and comment by INDOT before Design-Build Contractor releases the DMS for shipment.

Conduct final inspection and acceptance of the DMS after:

1. Approval of the product testing report
2. Approval of the FAT report
3. Delivery of the DMS to a site designated by INDOT
4. Proof and verification of the DMS continuous operation post-delivery
5. Approval of the reports documenting the results of the post-delivery test

Warranty

The DMS device and all ancillary equipment shall be covered under full manufacture warranty for parts for two years after Final Acceptance. The mounting of a radio antenna and/or pole to the DMS shall not void this warranty. The manufacturer shall submit warranty information on company letterhead to INDOT with the authorizing company representative's signature. Warranty information will include shipping and replacement part procedures that allow INDOT to obtain a warranty replacement of defective parts in a timely manner. Standard warranties will be issued in INDOT's name.

Supply a DMS factory-trained technician to observe and oversee the DMS and ACP installation process for each sign. The technician is to verify that the installation practices follow the DMS vendor's standard operating procedure and that DMS vendor's warranty was not in any way voided or limited during the installation.

Once accepted by INDOT and upon Design-Build Contractor's request, the DMS warranty will begin.

1. Warrant that:
2. All Work furnished pursuant to the contract documents will conform to all professional engineering principles generally accepted as standards of the industry in the state.
3. The DMS will be free of defects.
4. Materials and equipment furnished under the PPA Documents will be of good quality and, when installed, will be new.

   The Work will meet all of the requirements of the PPA Documents.

The Design Documents and Construction Documents for the DMS devices and ancillary equipment selected and prepared for use during Construction Work are appropriate for their intended use.

The Design-Build Contractor shall document all installation activities, including the quantity, brand, model/part numbers, and test results of all materials used. Provide an installer-signed list of the materials installed with the required documentation.

DMS Box Truss Structure

Overhead DMS shall be installed on DMS box trusses, per INDOT Standard Drawings.

Portable Changeable Message Signs

Portable Changeable Message Sign (PCMS) trailers shall be provided to facilitate traffic management in work zones during the construction and warn travelers to be prepared for construction activities and slowing traffic. The numbers and locations of PCMS trailers shall be determined by construction staging plans in accordance with INDOT Guidelines for PCMS, MOT, Haul Routes and Access.

The Design-Build Contractor shall coordinate with the Department to request the appropriate installation locations message(s) to display on the PCMS.

INTELLIGENT TRANSPORTATION SYSTEMS FIELD CABINETS

Design-Build Contractor shall furnish and install ITS controller cabinets per INDOT Standard Specifications and Standard Drawings. Design-Build Contractor shall design and install an appropriate foundation for the ITS controller cabinet in accordance with the applicable Department foundation design standard. Each cabinet foundation shall have a concrete footpad surrounding the foundation and shall be a minimum width of three feet. Materials

Design-Build Contractor shall be responsible for furnishing, insuring, transporting, and storing (for the interim) all materials associated with the ITS equipment cabinet, including power supply unit, equipment racks, circuit breakers, interface cables, and conduit entries.

Design Criteria

Each ITS equipment cabinet shall meet the required NEMA rating and shall be fabricated with approved material in accordance with pertinent Department standards.

Design-Build Contractor shall be responsible for the design and installation of work pads for maintenance and repairs, and guide railings or traffic barriers if within clear zones, as required by OSHA, INDOT TMC standards.

Concrete work pads shall be furnished and installed at each cabinet site to provide a level and dry maintenance platform for maintenance and repair activities. This Work shall also include excavation, gravel base, backfilling, and soil grading to support the concrete work pad at the cabinet site.

ITS equipment cabinets shall be designed for access by a single agency, unless joint access is explicitly agreed to by all involved stakeholders.

Construction Requirements

Design-Build Contractor shall be responsible for the design and installation of ITS equipment cabinets, concrete bases (for ground-mounted only), and concrete work pads.

The concrete work pads shall be level. Design-Build Contractor shall install conduit entries for fiber-optic communication drop cables from ITS backbone handholes and power conductors from power suppliers. All cables shall be labeled accurately to allow for future identification. Conduit stubs shall be provided and the number shall be configured for future power and communications usage in accordance with Department standards and requirements of the PPA Documents.

ITS Communications SystemGeneral

Materials

All fiber optics used in this Project shall be single-mode fiber. The general material elements are as follows:

Provide fiber-optic cables and fiber-optic cable splices as required to connect each ITS equipment cabinet and ITS elements to the existing backbone communication system in the final condition.

ITS field Ethernet switches shall support a minimum of 24 10/100 Ethernet ports. Provide two 10/100/1000/SFP-gigabit ports. Additionally, the switches shall support the following:

1. SFP support: SX, LX, XD, ZX, CWDM, 100FX, and T1
2. Resilient Stacking: up to 8 units/192 ports per stack
3. Stacking ports: 2 built-in HiStack ports per switch
4. Total stacking capacity: 320 gigabits per second
5. Individual switch packet throughput: 6.6 megapulses per second
6. Individual switch capacity: 48.8 gigabits per second
7. Concurrent VLANs: 256
8. Jumbo frame support on gigabit ports
9. Maximum MAC addresses: 8,000

All materials shall be furnished in accordance with the material requirements as stipulated under Department standards.

Design Criteria

Design-Build Contractor shall design drops off the existing fiber optic backbone to the ITS cabinets for connection to ITS elements. General design criteria elements are as follows:

Provide an Internet protocol (IP)-based system with a fully redundant architecture, allowing automatic failover of data flow to a secondary path or segment in the case of a primary equipment failure or fiber break. The ITS communication system backbone shall be rated for a 10-gigabit transfer rate, minimum. ITS field switches shall be rated for a 1-gigabit uplink transfer rate, minimum. Downlink ports at the field switches shall be 10/100BaseT.

Where required, Design-Build Contractor shall provide a field processor to act as terminal server, video encoder, and/or to perform data field processing.

The maximum number of elements assigned to a network path shall not exceed one-third of the path’s throughput capacity. Design-Build Contractor shall be responsible for providing any modifications to the existing communication networks required to integrate new devices.

The fiber optic network topology shall not include daisy chain as an option. All sites shall be home run to an existing core switch located at a communications hub.

Construction Requirements

All equipment and components shall be installed in accordance with the manufacturer’s recommended procedures. All fiber-optic terminations shall be labeled with an approved naming convention.

Testing Requirements

Design-Build Contractor shall conduct installation testing as part of the design and construction process, and component/subsystem testing during construction, to ensure that the devices perform per the manufacturer's specifications. Vendor-unique software or hardware used to verify proper operation of a component or used to troubleshoot a component may be used by Design-Build Contractor. Design-Build Contractor shall provide this vendor-unique software or hardware to INDOT as part of the test equipment package.

Design-Build Contractor shall also furnish INDOT with any special or unique test equipment that is required to maintain and/or test the system after Final Acceptance. The test equipment shall be identified in the associated Design Review submittal.

At the option of INDOT, certain items of support equipment shall be tested by being installed in place of a similar item of equipment in a field or central location that has already passed acceptance testing. Testing shall be witnessed by INDOT.

Tests shall be scheduled to allow a representative from INDOT to witness the test. INDOT shall be notified a minimum of 72 hours prior to the commencement of each test. All test plans and the test procedures for the component and/or subsystem being tested shall be approved by INDOT before any testing is conducted. Additionally, Design-Build Contractor shall provide INDOT 72 hours notification of an anticipated disruption of any services. Concealed Work (including underground) shall be tested by Design-Build Contractor and witnessed by INDOT prior to covering.

Instruments used by Design-Build Contractor shall be regularly and accurately calibrated and maintained in good working condition. Test reports shall include copies of documentation (calibration reports or tags) demonstrating calibration within one year of the start of testing. Design-Build Contractor shall provide all test instruments.

ITS Vaults and Handholes

Description

Design-Build Contractor shall provide handholes and vaults to support the cable and conduit installation of this Project.

Provide a vault at each planned fiber-optic cable splice location. Also provide a vault at one end of each bored conduit section. Space ITS vaults at no more than 2,000-feet intervals. Handholes may be proposed at interim locations to facilitate cable installation or relocations, with locations to be determined based on construction staging requirements.

Provide a communications handhole within 6 feet of each ITS location to facilitate the installation of cabling to the cabinet.

Materials

All handholes and vaults shall be in conformance with the Project Standards.

Construction Requirements

Handhole and vault covers shall be horizontally stamped as "TRAFFIC MANAGEMENT SYSTEM" across the center of the lid.

All conduit between handholes shall be complete and continuous. All connections between sections of conduit shall be made to be watertight and shall be tested with compressed air prior to installing cables. Grouting fill surrounding conduit entries at the handholes shall be made watertight.

Handholes shall be precast with the top of the handhole sloped to match the final grade.

Fiber-Optic Cable

Description

Under these items, Design-Build Contractor shall furnish and install ribbon-style, single-mode, fiber-optic cable of the number of fibers determined using the design criteria above.

Materials

The single-mode, fiber-optic cable shall incorporate a ribbon-style design. The cable shall be qualified to the requirements of Rural Utility Service (RUS) 7 CFR 1755.900 (PE-90) for armored cable (as required by this specification), and shall be new, unused, and of current design and manufacture.

Experience Requirements

Design-Build Contractor shall meet the experience requirements under the subsequent subsection, Fiber-Optic Drop Cable.

Fiber-Optic Drop Cable

Description

The fiber-optic drop cable is used for installing fiber-optic cable into ITS control cabinets and relay shelters. This ITS drop cable is used for connectivity between a primary fiber trunk, or feeder cable, and various field devices such as CCTV cameras at field locations as shown on the Plans.

Materials

The fiber-optic ITS drop cable shall include a factory pre-terminated, factory pre-tested connector module with pigtails that splice into the primary fiber trunk. This connector module mounts into the ITS field cabinet enclosure or on a standard 19-inch rack rail. The fiber-optic ITS drop cable shall have the following specifications:

1. Single mode
2. Fiber count: 6 fiber

   Connector #1: SC (factory pre-terminated)

   Connector #2: Pigtail length of 150 feet

Mounting plate for cabinet rack

Insertion Loss: 0.2 decibel typical

Return Loss: > -40 decibel SPC

5. Tensile Strength: 50 pounds (220 Newtons) <0.20 decibel change

6. Temperature Cycling: 40 degrees Fahrenheit (-40 degrees Celsius)
7. + 158 degrees Fahrenheit (70 degrees Celsius), 40 cycles < 0.20
8. decibel change

9. Ferrule material – Ceramic

Housing material – Acrylic, UL94V0

10. The cables shall use dispersion unshifted fibers. The fibers shall
11. comply with International Telecommunications Union (ITU) G.652.D. The optical and physical characteristics of the uncabled fibers shall include the following:

Core Diameter: 8.3 µm (nominal)

1. Numerical Aperture: 0.14

2. Zero Dispersion Wavelength: 1300-1322 nm

3. Zero Dispersion Slope: 0.092 ps/(nm^2*km) (maximum)

4. Cladding Diameter: 125.0 ± 0.7µm

5. Core-Clad Concentricity: 0.05µm maximum

6. Cladding Non-Circularity: 1 percent maximum

7. Coating Diameter: 245 ± 10 µm

8. Coating-Cladding Concentricity: 12 µm maximum

9. Mode Field Diameter: 9.2µm±0.4µm at 1310nm

10. Mode Field Diameter: 10.4µm±0.5µm at 1550nm

11. Dispersion: 18.0 ps/(nm*km) maximum at 1550nm

12.

The number of fibers in each cable shall be as determined in the design.

The maximum attenuation of any cabled fiber shall not exceed 0.4 decibels per kilometer at 1,310 nanometers and shall not exceed 0.3 decibels per kilometer at 1550 nanometers.

The cable shall be capable of withstanding a minimum-bending radius of 20 times its outer diameter during installation and 10 times its outer diameter during operation without changing the characteristics of the optical fibers.

The cable shall meet all of specified requirements under the following conditions:

1. Shipping/storage temperature: -58 degrees Fahrenheit to +158 degrees Fahrenheit (-50 degrees Celsius to +70 degrees Celsius)

2. Installation temperature: -22 degrees Fahrenheit to +158 degrees Fahrenheit (-30 degrees Celsius to +70 degrees Celsius)

3. Operating temperature: -40 degrees Fahrenheit to +158 degrees Fahrenheit (-40 degrees Celsius to +70 degrees Celsius)

4. Relative humidity from 0 percent to 95 percent, non-condensing

Armor

A steel armor, plastic coated on both sides, is required for direct buried cable installed under the provisions of this Technical Provision. An armor is optional for duct and aerial cable. The plastic- coated steel armor shall be applied longitudinally directly over the core wrap or the intermediate jacket and have a minimum overlap of 3.0 millimeters.

The uncoated steel tape shall be electrolytic chrome coated steel (ECCS) with a thickness of 0.155 ± 0.015 millimeters.

The reduction in thickness of the armoring material due to the corrugating or application process shall be kept to a minimum and shall not exceed 10 percent at any spot.

The armor of each length of cable shall be electrically continuous with no more than one joint or splice allowed per kilometer of cable. This requirement does not apply to a joint or splice made in the raw material by the raw material manufacturer.

The breaking strength of any section of an armor tape, containing a factory splice joint, shall not be less than 80 percent of the breaking strength of an adjacent section of the armor of equal length without a joint.

Construction Requirements

Coordinate layout and installation of fiber optic drop cable with other installations. Revise locations and elevations from those indicated as required to suit field conditions and as approved by INDOT at their sole discretion.

Experience Requirements

Personnel involved in the installation, splicing, and testing of the fiber-optic cables shall meet the following requirements:

Possess a minimum of three years' experience in the installation of fiber-optic cables, including fusion splicing, terminating, and testing single-mode fibers.

Demonstration of the installation two systems where fiber-optic cables are outdoors in conduit and where the systems have been in continuous satisfactory operation for at least two years. Design-Build Contractor shall submit as proof photographs or other supporting documents and the names,

addresses, and telephone numbers of the operating personnel who can be contacted regarding the satisfactorily installed fiber-optic systems.

Design-Build Contractor shall arrange for INDOT to witness, at INDOT's discretion, one satisfactorily installed fiber-optic cable system (which may be one of the two in the preceding paragraph) for each installer to provide proof of competency.

Installers shall be familiar with the cable manufacturer's recommended procedures for installing the cable. This shall include knowledge of splicing procedures for the fusion splicer being used on this Project and knowledge of all hardware such as breakout (furcation) kits and splice closures. Design-Build Contractor shall include documented procedures in the Construction QA/QC Plan to be used by construction inspectors.

Personnel involved in testing shall have been trained, by the manufacturer of the fiber-optic cable test equipment to be used, in fiber-optic cable testing procedures. Proof of this training shall be submitted to INDOT as part of the Construction Quality Management Plan. In addition, Design-Build Contractor shall submit documentation of the testing procedures for approval by INDOT.

Cable Installation in Conduit

Design-Build Contractor shall provide a cable-pulling plan, identifying where the cable will enter the underground system and the direction of pull. This plan will address locations where the cable is pulled out of a handhole/vault, coiled in a figure eight, and pulled back into the handhole. The plan shall address the physical protection of the cable during installation and during periods of downtime. INDOT will have 7 days to provide comment and installation shall not commence until all comments are satisfactorily addressed. INDOT's review will be for the operation on the highway and does not include an endorsement of the proposed procedures. Design-Build Contractor shall be responsible for the technical adequacy of the proposed procedures.

During cable-pulling operations, Design-Build Contractor shall ensure that the minimum bending of the cable is maintained during the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the handhole/vault conduit ports. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation-bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the cable manufacturers specifically approve the array.

The pulling tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable. Fuse links and breaks can be used to ensure that the cable tensile strength is not exceeded. The pulling system shall have an audible alarm that sounds whenever a preselected tension level is reached. Tension levels shall be recorded continuously and shall be given to INDOT upon request.

The cable shall be pulled into the conduit as a single component, absorbing the pulling force in all tension elements. The central strength member and Aramid yarn shall be attached directly to the pulling eye during cable pulling. "Basket grip" or "Chinese-finger type" attachments, which only attach to the cable's outer jacket, shall not be permitted. A breakaway

swivel, rated at 95 percent of the cable manufacturer's approved maximum tensile loading, shall be used on all pulls. When simultaneously pulling fiber-optic cable with other cables, separate grooved rollers shall be used for each cable.

Operation and Maintenance Documentation

After the fiber-optic cable plant has been installed, Design-Build Contractor shall submit to INDOT ten complete sets of operation and maintenance documentation. The documentation shall, as a minimum, include the following:

1. Complete and accurate as-built diagrams showing the entire fiber-optic cable plant, including the locations of all splices.
2. Final copies of all approved test procedures.
3. Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.
4. Complete parts list, including names of vendors.

Testing Requirements

Design-Build Contractor shall include detailed test procedures in the Construction Quality Management Plan prior to any tests being conducted. All fibers shall be tested bi-directionally at both 1,310 nanometers and 1,550 nanometers with both an optical time-domain reflectometer (OTDR) and a power meter and optical source. For testing, intermediate breakout fibers may be concatenated and tested end to end. Design-Build Contractor shall resolve any discrepancies between the measured results and the requirements of this section to the satisfaction of INDOT.

Design-Build Contractor shall provide the date, time, and location of any tests required by this section to INDOT. Upon completion of the cable installation, splicing, and termination, Design-Build Contractor shall test all fibers for optical continuity loss, events above 0.1 decibels, and total attenuation of the cable. The test procedure shall be as follows:

A certified technician utilizing an OTDR and optical source/power meter shall conduct the installation test. The technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

The method of connectivity between the OTDR and the cable shall be a factory patch cord of a length equal to the "dead zone" of the OTDR. Optionally, the technician can use a factory "fiber box" of 328 feet minimum with no splices within the box.

1. At the completion of the test, Design-Build Contractor shall provide two copies of documentation of the test results to INDOT. The test documentation shall be submitted as both a bound copy and a USB flash drive and shall include the following:

Cable and Fiber Identification:

a. Cable ID

b. Cable location – beginning and end point

c. Fiber ID, including tube and fiber color

Operator name

Date and time

Set-up parameters

2. Wavelength

3. Pulse width (OTDR)

4. Refractory index (OTDR)

5. Range (OTDR)

6. Scale (OTDR)

7. Set-up option chosen to pass OTDR "dead zone"

8. Test results:

9. a. OTDR test

b. Total fiber trace

c. Splice loss/gain

d. Events > 0.10 decibels

10. Physical length (cable marking)

11. Fiber length (OTDR)

12. Optical source/power meter

13. Total attenuation

14. Attenuation (dB/km)

15. File format for the OTDR Test Results: The file format for the OTDR test results shall be Bellcore/Telcordia-compliant according to GR-196-CORE Issue 2, OTDR Data Standard:

16. GR 196, Revision 1.0

GR 196, Revision 1.1

GR 196, Revision 2.0 (SR-4731)

1. These results shall be provided in tabular form. The following shall be the criteria for the approval of the cable:

The test results shall show that the decibel per kilometer loss does not exceed +3 percent of the factory test or 1 percent of the cable's published production loss. However, no event shall exceed 0.10 decibels. If any event is detected above 0.10 decibels, Design-Build Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (decibel), less events, shall not exceed the manufacturer's production specifications as follows: 0.5 decibels per kilometer at 1,310 nanometers and 0.4 decibels per kilometer at 1,550 nanometers.

2. If the total loss exceeds these specifications, Design-Build Contractor shall replace or repair that cable run at Design-Build Contractor's expense, both labor and materials. Elevated attenuation due to exceeding the pulling tension during installation shall require the replacement of the cable run at Design-Build Contractor's expense, including labor and materials.

The Design-Build Contractor shall label the destination of each trunk cable onto the cable in each handhole, vault, or cable termination panel.

Splicing Requirements

Splice locations shall be permitted only with the written approval of the Department. For approved locations, mainline splices will concatenate the fibers from the two cable segments, that is, the colors of the buffer tubes and fibers shall be the same across the splice. For splices that breakout the individual fibers, the fiber assignments shall be included in the submittal to the Department.

Slack Storage of Fiber-Optic Cables

As part of these items, slack fiber shall be supplied as necessary to allow splicing the fiber-optic cables in a controlled environment, such as a splicing van or tent. The following slack shall be provided:

1. ITS Cabinet: 5 feet
2. ATMS Handhole: 20 feet
3. ATMS Vault: 100 feet
4. Shelter, Relay: 100 feet

After splicing has been completed, the slack fiber shall be stored underground in ATMS vaults.

Cable Tagging

Fiber-optic cable shall be tagged inside handholes with yellow tape containing the text "CAUTION - FIBER OPTIC CABLE." In addition, permanent tags, as approved by INDOT, shall be attached to all cable in a handhole or other break-out environment. These tags shall be stainless steel, nominally 0.75 inches by 1.72 inches, and permanently embossed. These tags shall be attached with stainless steel straps and shall identify the cable number, the number of fibers, and the specific fiber count. Tags and straps shall be American Labelmark, Ideal Industries, National Band and Tag, Panduit, Seton Name Plate, Standard Signs, W.H. Brady, or approved equal.

FIBER-OPTIC SPLICE

Description

Design-Build Contractor will splice optical fibers from different cable sheaths and protect them with a splice enclosure at the locations shown on the Plans. Fiber splicing consists of in-line fusion splices for all fibers described in the cable plan at the particular location.

Two basic types of splices are identified. In a drop cable splice, the buffer tubes in the mainline cable are dressed out, and those fibers identified on the Plans are accessed and spliced to drop cables. A mainline splice involves the splicing of all fibers in the cable sheath to a second, continuing cable.

Materials

Splice enclosures shall be designed for use under the most severe conditions, such as moisture, vibration, impact, cable stress, and flex temperature extremes, as demonstrated by successfully passing the factory test procedures and minimum specifications listed below:

Physical Requirements

The enclosures shall provide ingress for up to four cables in a butt configuration. The closure shall prevent the intrusion of water without the use of encapsulates. For combined mainline and drop cable splices, a single-splice enclosure shall be used.

The enclosure shall be capable of accommodating splice organizer trays that accept mechanical or fusion splices. The splice enclosure shall have provisions for storing fiber splices in an orderly manner, mountings for splice organizer assemblies, and space for excess or un-spliced fiber. Splice organizers shall be re-enterable. The splice case shall be UL rated.

Enclosure re-entry and subsequent reassembly shall not require specialized tools or equipment. Furthermore, these operations shall not require the use of additional parts.

The splice enclosure shall have provisions for controlling the bend radius of individual fibers to a minimum of 1.5 inches (38 millimeters).

For splices in armored cables, the splice closure shall provide a method of bonding the armor from all sheaths entering the closure. It shall also provide a means of grounding the armor and closure at the splice location.

Factory Testing

Compression Test

The closure shall not deform more than 10 percent in its largest cross-sectional dimension when subjected to a uniformly distributed load of 300 pound-force (1,335 Newtons) at temperatures of 0 and 100 degrees Fahrenheit (−18 and 38 degrees Celsius). The test shall be performed after stabilizing at the required temperature for a minimum of two hours. It shall consist of placing an assembled enclosure between two flat parallel surfaces, with the longest enclosure dimension parallel to the surfaces. The weight shall be placed on the upper surface for a minimum of 15 minutes. The measurement shall then be taken with weight in place.

Impact Test

The assembled enclosure shall be capable of withstanding an impact of 20.7 foot-pound force (28 N-M) at temperatures of 0 and 100 degrees Fahrenheit (-18 and 38 degrees Celsius). The test shall be performed after stabilizing the enclosure at the required temperature for a minimum of two hours. The test fixture shall consist of 20-pound (9 kilogram) cylindrical steel impacting head with a 2-inch (50-millimeter) spherical radius at the point where it contacts the enclosure. It shall be dropped from a height of 12 inches (305 millimeters). The enclosure shall not exhibit any cracks or fractures to the housing that would preclude it from passing the water immersion test. There shall be no permanent deformation to the original diameter or characteristic vertical dimension by more than 5 percent.

Cable Gripping and Sealing Testing

The cable gripping and sealing hardware shall not cause an increase in fiber attenuation in excess of 0.05 decibels per fiber at 1,550 nanometers when attached to the cables and the enclosure assembly. The test shall consist of measurements from six fibers, one from each buffer tube or channel, or randomly selected in the case of a single fiber bundle. The measurements shall be taken from the test fibers before and after assembly to determine the effects of the cable gripping and sealing hardware on the optical transmission of the fibers.

Vibration Test

The splice organizers shall securely hold the fiber splices and store the excess fiber. The fiber splice organizers and splice-retaining hardware shall be tested per EIA Standard FOTP-II, Test Condition 1. The individual fibers shall not show an increase in attenuation in excess of 0.1 decibels per fiber.

Water Immersion Test

The enclosure shall be capable of preventing a 10-foot (3-meter) water head from intruding into the splice compartment for a period of seven days. Testing of the splice enclosure is to be accomplished by the placing of the enclosure into a pressure vessel and filling the vessel with tap water to cover the enclosure. Apply continuous pressure to the vessel to maintain a hydrostatic head equivalent 10 feet (3 meters) on the closure and cable. This process shall be continued for 30 days. Remove the enclosure and open to check for the presence of water. Any intrusion of water in the compartment containing the splices constitutes a failure.

Certification

Design-Build Contractor shall ensure that either the manufacturer or an independent testing laboratory has performed all of the above tests, and that the appropriate documentation has been submitted to INDOT. Manufacturer certification is required for the model(s) of enclosure supplied. It is not necessary to subject each supplied closure to the actual tests described herein.

Construction Requirements

The enclosure shall be installed according to the manufacturer's recommended guidelines. For mainline splices, the cables shall be fusion spliced. Forty-five days prior to start of the fiber-optic cabling installation, Design-Build Contractor shall submit the proposed locations of

the mainline splice points for review and comment by INDOT. The minimum distance between mainline splice points shall be at least 1000 feet.

Design-Build Contractor shall prepare the cables and fibers in accordance with the enclosure and cable manufacturers' installation practices. A copy of these practices shall be provided to INDOT for review and comment 21 days prior to splicing operations.

Using a fusion splicer, Design-Build Contractor shall optimize the alignment of the fibers and fuse them together. Design-Build Contractor shall recoat the fused fibers and install mechanical protection over them.

Upon completing all splicing operations for a cable span, Design-Build Contractor shall measure the mean bi-directional loss at each splice using an OTDR. This loss shall not exceed 0.1 decibel.

Design-Build Contractor shall measure the end-to-end attenuation of each fiber, from connector to connector, using an optical power meter and source. This loss shall be measured from both directions and shall not exceed 0.5 decibel per installed kilometer of single-mode cable. Measurements shall be made at both 1,300 and 1,550 nanometers for single-mode cable.

The cable installation shall satisfy the requirements of both the NEC (NFPA-70-2008) and the National Electric Safety Code (IEEE C2-2007). The standards require that the armor be bonded and grounded any time that the armor is interrupted or exposed by opening the sheath. These documents also provide minimum separations from foreign utilities.

For splices in armored cables, Design-Build Contractor shall ground the splice closure using a #6 AWG conductor or equivalent.

As directed by the sole discretion of INDOT, Design-Build Contractor, at no additional cost to INDOT, shall replace any cable splice not satisfying the Project Standards, PPA Documents, including this Section 16.

Design-Build Contractor shall secure the splice enclosure to the side of the splice facility using cable support brackets. All cables shall be properly dressed and secured to rails or racks within the ATMS vault. No cables or enclosures will be permitted to lie on the floor of the splice facility. Cables that are spliced inside a building will be secured to the equipment racks or walls as appropriate and indicated on the Plans.

FIBER-OPTIC PATCH CABLES

Description

This section describes furnishing fiber-optic patch cables for making fiber- optic network device connections with SC and LC connectors as shown on the Plans. This includes patch panel connections, network card connections, and other equipment.

Materials

All conductors shall have the following specifications:

Multimode Patch Cord

Attenuation:

1. 850 nanometers: 3.0 decibels per kilometer
2. 1,310 nanometers: 1.0 decibels per kilometer
3. Bandwidth:
4. LED: 1500/500 megahertz per kilometer OFL at 850/1,310 nanometers
5. 2000/500 megahertz per kilometer RML at 850/1,310 nanometers
6. Diameters Core: 50 µm
7. Cladding: 125 µm
8. Buffer: 900 µm
9. Fiber Type: Laser-optimized multimode
10. Jacket: PVC
11. Operating Temperature: -40 to +185 degrees Fahrenheit (-40 to +85 degrees Celsius)

Single Mode Patch Cord

1. Bend radius: Meets ANSI/TIA/EIA-568B.3 standard
2. Cladding: 125 µm
3. Core: 9 µm
4. Crush resistance: 750 Newtons per centimeter
5. Ferrule: Ceramic
6. Housing: Composite
7. Insertion Loss: 0.2 decibels typical
8. Operating Temperature: - 4 to +158 degrees Fahrenheit (-20 to +70 degrees Celsius)
9. Return Loss: ≥55 typical

Tensile Strength: 240 Newtons (54 pounds per 24.5 kilograms)

Wavelength: 1,310 nanometers, 1,550 nanometers

Maximum attenuation: 0.4 decibels, typical 0.2 decibels

10.

11. **Construction Requirements**

12. Coordinate the layout and installation of fiber patch cables with other installations. Revise locations and elevations from those indicated as required to suit field conditions and as approved by INDOT.

FIBER-OPTIC PATCH PANEL ASSEMBLY

Description

This section describes furnishing fiber-optic patch panels for making fiber- optic terminations at the cable demarcation point sites. The fiber patch panel assembly consists of the following:

One fiber closet connector housing

Eight fiber panels

1. **Materials**

The fiber patch panels shall have the following specifications:

2.

Rack mountable for 19-inch rack 4U in size

Housing accepts up to 12 SC simplex or SC duplex connector panels

1. connector panels shall be single-mode in 12 fiber configuration

2. Meets requirements of ANSI/TIA/EIA-568A and 606

3. SC adapters have ceramic sleeves

4.

5. **Construction Requirements**

Coordinate the layout and installation of fiber patch panels with other installations. Revise locations and elevations from those indicated as required to suit field conditions and as approved by INDOT. The splice shall be a fusion splice as specified in the Technical Provisions and shall not exceed 0.1 decibels. Design-Build Contractor shall measure the mean bi-directional loss at each splice using an OTDR and provide the results to INDOT.

FIBER GIGABIT INTERFACE CARD MODULES

Description

The Fiber Gigabit Interface Card (GBIC) module inserts into the ITS switches to allow for a fiber connection.

Materials

The Fiber GBIC module shall be compatible with the ITS field, field relay, and core switches.

The Fiber GBIC module shall provide performance as follows:

1. Operating temperature of 32 degrees to degrees 140 degrees Fahrenheit
2. Connector type of LC
3. Medium Time Between Failure (MTBF) of 807,000 hours
4. Distance Range:
5. Short up to 500 meters for 50 µm multimode fiber
6. Medium up to 10 kilometers for 9 µm single-mode fiber
7. Long up to 40 kilometers for 9 µm single-mode fiber
8. Extended up to 70 kilometers for 9 µm single-mode fiber
9. Optical Budget:
10. Short 7 decibels
11. Medium 10.5 decibels
12. Long 17 decibels
13. Extended 20 decibels
14. Transmit/Receive wavelength:
15. Short: 850 nanometers
16. Medium: 1,310 nanometers
17. Long: 1,470-1,610 nanometers
18. Extended: 1,550 nanometers

Construction Requirements

Fiber GBIC cards shall be installed at each site that is to be connected to fiber.

INTELLIGENT TRANSPORTATION SYSTEM FIELD ETHERNET SWITCH, MANAGED

Description

The ITS field Ethernet managed switch is used to connect communications equipment and the AFP at camera sites, as well as provide relay communications to the ATMS network.

Materials

Provide materials conforming to the following specifications: Avaya 4526-T

Construction Requirements

Design-Build Contractor shall install the ITS field relay Ethernet switch in accordance with the manufacturer's instructions. Installation shall include all cables, mounting hardware, power supplies and associated equipment required to mount and interface the spur low-speed communications subsystem. Document all installation activities, including the quantity, brand, model/part numbers, test results of all materials used. Provide an installer-signed list of the materials installed with the required documentation.

INTELLIGENT TRANSPORTATION SYSTEM CORE ETHERNET SWITCH, MANAGED

Description

The ITS core Ethernet switch is used to connect the fiber backbone of the ITS field equipment to the rest of the communications network. This switch will be located in a conditioned shelter or building. The ITS core switch consists of the following:

1. One chassis with at least six slots
2. Two 100-240 VAC 1140W/1462W power supplies with appropriate power cord
3. Two switch fabric modules with 256 Gbps switch fabric capacity, 1.3 GHz CPU, 1 GB memory and compact flash slot
4. Two Ethernet interface modules with eight ports of autosensing 10Base-T/100Base-TX/1000Base-T, 24 ports for SFP style GBIC card and two 10Gigabit XFP style GBIC cards. Module shall be vendors' most current model with exact port counts listed above. Two 48-port autosensing 10Base-T/100Base-TX/1000Base-T Ethernet interface modules
5. One software kit, including base software necessary for operation of the switch. Design-Build Contractor shall obtain the latest version available from the manufacturer

Functional requirements:

1. Meet 99.999-percent error free operation; multiple protocol data communication over fiber optic and copper transmission mediums.
2. Perform to stated specifications over a temperature range of 32 degrees to 104degrees Fahrenheit and a humidity of 85 percent relative noncondensing.
3. Shall operate on 120 volt (plus or minus 10 percent) 60 Hz commercial power.
4. Standard EIA 19-inch rack mountable.

1. **Materials**

Provide materials conforming to the following specifications:

2. Switch architecture: 720Gbps gross throughput
3. Switch Fabric performance: up to 512Gbps in an Active/Active configuration
4. Frame forwarding rate: up to 380Mpps
5. Frame length: 64 to 1518 Bytes (802.1Q Untagged), 64 to 1522 bytes (802.1Q Tagged)
6. Jumbo Frame support: up to 9,000 Bytes (802.1Q Tagged)

Multi-Link Trunks: up to 128 Groups, with 8 Links per Group

VLANs: up to 4,000 Port/ Protocol/802.1Q-based

Multiple Spanning Tree Groups: up to 32

MAC Address: up to 64k

7. IP Interfaces: 1,972
8. Dynamic ARP Entries: up to 32k
9. VRRP Interfaces: up to 255
10. IP Forwarding Table: 250k
11. ECMP Routes: up to 5k
12. RIP Instances: up to 64
13. RIP Interfaces: up to 200
14. RIP Routes: up to 10k
15. OSPF Instances: up to 64
16. OSPF Adjacencies: up to 80
17. OSPF Routes: up to 50k
18. BGP Peers: up to 250
19. BGP Routes: up to 250k
20. SPB C-VLANs: up to 1,500
21. SPB IS-IS Adjacencies: up to 50
22. SPB IP Routes for L3 VSN: up to 25k
23. SPB IP Routes for IP VPN-Lite/SPB: up to 250k
24. VRF-Lite Instances: up to 255
25. MPLS LDP LSPs: up to 16k
26. MPLS Tunnels: up to 2,500
27. PIM Active Interfaces: up to 200
28. PIM Neighbors: 80/up to 200 for all VRFs
29. IP Multicast Streams: up to 4k

Construction Requirements

The ITS core switch shall be installed in accordance with the manufacturer's instructions and per the Plans. All materials shall be installed in a neat and professional manner, subject to INDOT's approval. All installation services will comply with all warranty provisions and warranty contract maintenance services in accordance with these specifications.

Installation shall include all cables, mounting hardware, power supplies and associated equipment.

Document all installation activities, including the quantity, brand, model/part numbers, test results of all materials used. Provide installer signed list of the materials installed with the required documentation.

Integrate and test the switch and connections to communications equipment at the TMC's in Gary and Indianapolis.

PADLOCKS

Description

This Work shall consist of furnishing and installing padlocks for all cabinets, fence gates, box truss ladder gates, and enclosures specified in these Technical Provisions.

Materials

The padlock shall be classified as a high-security padlock with hardened shackle, laminated body, and 4-pin cylinder (minimum), and shall come complete with a weather cover to protect the lock body and cylinder from sand, dirt, water and ice. A wafer cylinder shall not be used. Keys shall be provided to INDOT with each padlock supplied. All padlocks shall be keyed alike and identical to the keys currently in use by INDOT. The main body width of the padlock shall not exceed 3 inches and shall have a shackle length of 2.25 inches to 3.75 inches and a shackle diameter of 0.3125 inches.

Construction Requirements

For padlock information, contact the ITS Field Engineer, Indiana Department of Transportation, at 8620 East 21st Street, Indianapolis, Indiana 46219, (317) 899-8606. The contact person for the Gary TMC is Marc Antich, (219) 938-2016.

INTELLIGENT TRANSPORTATION SYSTEM ELECTRICAL POWER

Power Service Drop

Description

Work under this item shall include furnishing and installing all equipment necessary to provide a complete service point power entry. Electrical service, where required, shall be provided by the appropriate Utility Owner. A 100 Amp, 240/120 volts alternating current, 1-phase, 3-wire service shall be provided at power service drop locations. The service point locations shall be coordinated with the appropriate Utility Company. Work under this item includes overhead and underground service power drops for 120/240 volt. Design-Build Contractor shall pay for all costs required by the utility for service installation.

After coordination with the power company's representative, Design-Build Contractor shall submit a connection request form to INDOT. The Department shall forward this form to the power company, and INDOT will be responsible for paying bills after service is connected. The service drops shall be in accordance with these provisions and with 807.15.

Materials

The service drops shall be sized and equipped to support the electrical loads of the equipment. Meter sockets shall be installed in accordance with the requirements of the utility. Grounding shall be in accordance with 807.12 and shall be part of the service installation.

The outdoor rated disconnect switch shall be a NEMA 3R enclosure with multi-position (4 or 6) circuit breaker panel with 100 amp main circuit breaker, 3 pole, 600 volts. The enclosure shall be lockable with a padlock. Padlocks are to be in accordance with the padlock provisions.

In the event that the service point and cabinet are separated by mainline roadway lanes, collector/distributor lanes, ramp lanes or a distance greater than 500 feet (as measured along the electrical wire from the service point to the cabinet), an additional 3R rated electrical disconnect shall be installed within 25 feet of the ITS controller cabinet/DMS as a safety disconnect device.

Construction Requirements

All electrical Work associated with the service power drop installations shall be in accordance with the Design Documents, Construction Documents, Project Standards, and the manufacturer's written instructions.

As identified in the Plans or per INDOT request, where the proposed service point is more than 500 feet from the ATMS remote site, a second disconnect shall be provided at the ATMS site.

Wires and Cables

Description

This section shall consist of furnishing and installing wires and cables, and making all connections. The following sections of the Standard Specifications relate specifically to this section: 807; n 805; 920.01(c.

Deliver wire and cable according to NEMA WC-26.

Materials

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. American Insulated Wire Corp., Leviton Manufacturing Co.
2. Brand-Rex Cable Systems, Brintec Corp.
3. Carol Cable Company, Inc.
4. Senator Wire & Cable Co.
5. Southwire Co.

Connector vendors for wires and cables:

1. Teledyne Penn-Union
2. ILSCO
3. Thomas & Betts Corp.
4. Electrical Products Division, 3M Co.
5. O-Z/Gedney Unit, General Signal

All conductors shall have insulation rated at 600 volts alternating current, with conductor temperatures not to exceed 194 degrees Fahrenheit (90 degrees Celsius) in dry locations and 167 degrees Fahrenheit (75 degrees Celsius) in wet locations.

Service Entrance: Type XHHW, copper conductor, in raceway

Branch Circuits: Type XHHW, copper conductor, in conduit at ATMS equipment cabinets/enclosures.

Connectors and Splices: UL-listed factory fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with this Project’s installation requirements.

Construction Requirements

Coordinate layout and installation of cable with other installations. Revise locations and elevations from those indicated as required to suit field conditions and as approved by INDOT.

All components and installation shall comply with NFPA 70, NEC. Provide products specified in this section that are listed and labeled as defined in the NEC, Article 100.

The Design-Build Contractor shall install wires and cables as indicated, according to the manufacturer's written instructions and the National Electrical Contractors Association Standard of Installation.

The Design-Build Contractor shall pull conductors into raceway simultaneously where more than one is being installed in same raceway.

The Design-Build Contractor shall use pulling compound or lubricant where necessary; compound used shall not deteriorate conductor or insulation.

The Design-Build Contractor shall use pulling means; including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceway.

The Design-Build Contractor shall minimize conductor splices where possible.

All splices and connections shall comply with 807.

The Design-Build Contractor shall install splices and covers that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

The Design-Build Contractor shall use splice and tap connectors that are compatible with conductor material.

The Design-Build Contractor shall examine conduits to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

Testing

Upon installation of wires and cables and before electrical circuitry has been energized, the Design-Build Contractor shall demonstrate product capability and compliance with requirements.

Procedures

The Design-Build Contractor shall perform each visual and mechanical inspection and electrical test stated in InterNational Electrical Testing Association Standard ATS, Section 7. Certify compliance with test parameters.

The Design-Build Contractor shall correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

Power Vaults and Handholes

Materials

All handholes and vaults shall be in conformance with the Project Standards for construction.

Design Criteria

Design-Build Contractor shall provide handholes and vaults to support the cable and conduit installation of this Project.

The Design-Build Contractor shall provide a power handhole within 6 feet of each ITS location to facilitate the installation of cabling to the cabinet.

Construction Requirements

Handhole and vault covers shall be stamped as “TRAFFIC MANAGEMENT POWER” horizontally, across the center of the lid.

All conduits between handholes and/or vaults shall be complete and continuous. All connections between sections of conduit shall be made to be watertight and shall be tested with compressed air prior to installing cables. Grouting fill surrounding conduit entries at the handholes shall be made watertight.

Handholes shall be precast with the top of the handhole sloped to match the final grade. Vaults shall be installed such that the top is level and grading surrounding the vault shall be made level. Design-Build Contractor shall provide retaining walls as necessary to support the grading requirement.

INTELLIGENT TRANSPORTATION SYSTEM CONDUIT

Materials

Conduit materials shall be in accordance with the Project Standards.

Design Criteria

Design-Build Contractor shall provide a minimum of one 2-inch HDPE Schedule 80 conduit for electrical power and three 1.25-inch conduits of different colors (blue, orange, and green) for fiber communications. Provide additional conduit and larger conduit where required to meet the needs of this Project. Conduit installed for this Project shall support 100 percent expansion of the ITS. To support system expansion, maximum conduit fill for all new conduits shall not exceed 0.5 of the fill percentage recommended by Table 1, Chapter 9, of the NEC.

Wherever possible, conduit shall be installed in common trenches.

Bored conduit shall be installed perpendicular to roadway or other paved crossings.

All conduits shall be locatable, either by installing a tonable pull tape, armored fiber optic cable, or copper wire within the conduit wall.

Construction Requirements

Design-Build Contractor shall be responsible to repair any pavement or concrete that is damaged by boring operations. Design-Build Contractor shall install trenched, bored, or structurally mounted conduit in accordance with the Project Standards.

During trench backfilling, for exterior underground power, signal, and communications lines, Design-Build Contractor shall install continuous underground plastic line marker, located directly above line at 6 inches to 8 inches below finished grade. Where multiple lines are installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.