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General Instruction To Field Employees

AASHTOWare Projects Edition

Construction Management and District Support

INDIANA DEPARTMENT OF TRANSPORTATION INDOT

Issued November 2025

FOREWORD

The General Instructions to Field Employees (GIFE) manual is intended for use by field personnel assigned to Indiana Department of Transportation construction projects.

The purpose of the manual is to establish standard procedures for construction administration and inspection activities with the intent that field personnel will carry out their duties in a uniform manner throughout the State.

There are many areas that are not yet covered by this manual and in general, standard Department practice should be followed in lieu of specific instructions until those areas are addressed. Field personnel should contact their supervisor with specific questions about procedure.

These instructions cannot cover every contingency and field personnel are expected to use their best judgment in dealing with the specific and unusual situations that arise on any project. However, Department personnel are expected to apply these established procedures to the best extent possible on any given project.

The use of this manual by others is solely at the risk of the user. The Department does not warrant the accuracy of the contents of the manual or any of its supporting material.

Questions about the instructions and suggestions for improvement should be directed to the Division of Construction Management.

REVISIONS

The GIFE will be revised as necessary to keep information current with Department standards, policies and procedures.

When a revision is issued, the new or revised information will be indicated by highlighting and the revision date will be noted next to the title of the subsection revised. The revision date in the upper right-hand corner of each section will be changed to indicate the latest revision date of any subsection within the section. If an entire section or subsection is added, only the section or subsection title will be highlighted, otherwise only the new or revised text will be highlighted. Highlighting will be removed from the revised portions once a subsequent GIFE revision is issued.

Date	Section number and revision description
12-01-25	**1.1** (updated), **3.2** (added new), **3.3** through **3.25** (edited subsections sequence), **3.4** (revised), **26.8** (added new), and **29.2** (revised) - *(See* SC June 19, 2025, meeting)
11-01-25	AWP version of the GIFE issued.

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Section 1:

Introduction

SECTION 1 – INTRODUCTION

1.1 ACRONYMS *(rev. 12-01-25)*

Whenever the following abbreviations are used in this manual, standard specifications, or citation they are to be construed the same as the respected expressions represented.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	American Disabilities Act
AE	Area Engineer
ATSSA	American Traffic Safety Services Association
AWP	AASHTOWare Projects
AWS	American Welding Standards
CCO	Construction Change Order
CCT	Construction Certified Technician
CIB	Contract Information Book
CM	Construction Management (Division)
CMD	Concrete Mix Design
CO	Central Office
CPMS	Contractor Payment Management System
CRC	Continuous Reinforced Concrete
CRI	Cost Reduction Incentive
CSGP	Construction Stormwater General Permit
CWTS	Certified Worksite Traffic Supervisor
DBE	Disadvantaged Business Enterprise
DC	Deputy Commissioner
DCD	District Construction Director
DCM	Director of Construction Management
DDC	District Deputy Commissioner
DHPA	Division of Historic Preservation and Archeology
DMF	Design Mix Formula
DMT	District Materials and Tests
DMTE	District Materials and Tests Engineer
DNR	Department of Natural Resources
DO	District Office
DT	District Traffic
DTE	District Traffic Engineer
EEO	Equal Employment Opportunity
ES	Environmental Services
ESAL	Equivalent Single Axle Load
ESC	Erosion and Sediment Control
FCR	Final Construction Record
FE	Field Engineer (CO Construction Management Division)
FHWA	Federal Highway Administration

F.O. B	Free on Board
GIFE	General Instructions to Field Employees
GPS	Global Positioning System
GS	Geotechnical Services
HMA	Hot Mix Asphalt
HT	Highway Technician/Inspector
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IMSA	International Municipal Signal Association
INDOT	Indiana Department of Transportation
IOSHA	Indiana Occupational Safety and Health Agency
IRI	International Roughness Index
ITM	Indiana Test Method or Procedures
IVOSB	Indiana Veteran Owned Small Business
JMF	Job Mix Formula
LPA	Local Public Agency
M&T	Division of Materials and Tests
MBE	Minority Business Enterprise
MOT	Maintenance of Traffic
MPO	Metropolitan Planning Organization
MS4	Municipal Separate Storm Sewer Systems
MSG	Maximum Specific Gravity
MUTCD	Manual of Uniform Traffic Control Devices
NAICS	North American Industry Classification System
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NOT	Notice of Termination
NRC	Nuclear Regulatory Commission
OFCCP	Office of Federal Contract Compliance Programs
OG	Original Ground
PCBMP	Post-Construction Best Management Practices
PCC	Portland Cement Concrete
PCCP	Portland Cement Concrete Pavement
PCN	Project Control Number
PEMS	Project Engineer/Manager/Supervisor
PG	Performance Grade (Asphalt)
PIO	Public Information Office
PM	Project Manager
PR	Pay Rolls
QA	Quality Assurance
QC	Quality Control
QC/QA	Quality Control/Quality Assurance
QCP	Quality Control Plan
RC	Reinforced Concrete
RCRA	Resource Conservation and Recovery Act

ROW	right-of-way
RPD	Recurring Plan Detail
RRS	Railroad Section
RSP	Recurring Special Provision
SCE	State Construction Engineer
SS	Standard Specifications
SSPC	The Society for Protective Coatings
SWP3	Stormwater Pollution and Prevention Plan
SWQCP	Stormwater Quality Control Plan
SWQM	Stormwater Quality Manager
TCLP	Toxicity Characteristic Leaching Procedure
TCT	Testing Certified Technician
US EPA	United States Environmental Protection Agency
USACE	U. S. Army Corps of Engineer
USP	Unique Special Provision
UST	Underground Storage Tanks
WBE	Women’s Business Enterprise

Section 2:

General Instructions

SECTION 2 – GENERAL INSTRUCTIONS

2.1 CONSTRUCTION INSTRUCTIONS

These instructions are intended to assist in the interpretation of the contract documents. These instructions do not supersede or amend the contract documents and hold no contractual obligation on the Contractor. These instructions are intended as requirements for Department personnel under most circumstances encountered during a contract. When the instructions do not accommodate a specific issue or are not followed in a particular instance, the reason for deviating from the instructions should be clearly documented so those who may review or audit the project records can understand the reason for the deviation.

Updating the GIFE is an ongoing process. Sometimes additional or revised instructions will be issued by means of Construction Memorandums. Such memoranda will become as binding on the project personnel as these instructions. A full listing of current Construction Memorandums is available on the Department's website.

These instructions are intended to cover the construction features of the work that have created problems in the past as well as the preparation of forms, reports and records pertaining to the progress of work performed.

All questions related to matters pertaining to field construction, such as alignment, grade or structure changes, interpretations of the specifications, matters pertaining to materials and tests etc., should initially be addressed with the AE.

2.2 CONTRACT

A copy of the CIB will be furnished to the PEMS. The CIB will include a proposal page and the Schedule of Pay Items for the contract. In addition, the CIB may also include plan sheets, RPDs, RSPs, and USPs. Additional information about permits, asbestos investigations, etc. may also be included. It is essential that the CIB be reviewed so that the correct specifications will be used. The PEMS should also be familiar with the hierarchy of contract documents as shown in section 105.04.

The contract may be adjusted as necessary and as approved by the use of a change order.

A set of construction plans must be marked in red as work progresses to show all changes that have been made during construction. These plans are to be labeled "As Built" and are to be submitted to the DO with the FCR.

In general, "As Built" plans are to be produced by the PEMS unless an RSP or USP requires the Contractor to prepare the plans. If this is the case, final payment of the contract will not be made until the "As Built" plans have been submitted to the PEMS.

2.3 INITIAL DUTIES OF THE DISTRICT

The DO will notify all utilities, governmental units, railroads, and any other organization utilizing the ROW, of the planned construction and invite them to the pre-construction conference.

When the contract is let, the DCD will draft a letter to the County Surveyor of the county or counties in which the contract is located. The letter will request the county official to advise the DO, in writing, of the locations of any established corners and legal drains that fall within the limits of the contract. Transmitted with the letter should be a strip map showing the locations of the project (similar to the detail on the title sheet of the plans). This letter should quote the following from IC 8-23-9-24:

> "If in the construction or maintenance of a state highway it is necessary to remove or bury a monument marking or evidencing an established corner, the department shall cause to be set in the pavement or right-of-way at the place where the monument was located a monument capable of activating a metal detection device. The top of the monument must be level with the pavement or the grade of the right-of-way. The department shall cause a memorandum of the monument to be filed in the county surveyor's office of the county."

The law requires the construction of a monument wherever it is necessary to remove or bury an established corner. An established corner has been interpreted to mean any land section, 1/2 section corner, etc., or any property corner, provided such corner has been officially established by a person authorized by law. In general, only a County Surveyor or a professional land surveyor has authority to officially establish corners.

2.4 PRE-CONSTRUCTION CONFERENCE

A pre-construction conference must be set-up with the contractor for a date prior to the beginning of the first work. The time and place for the meeting should be sent to all parties, on whose part action will be required in the construction of the work. This should be far enough in advance for them to arrange their representation. The Department's website provides an agenda of topics for the pre-construction conference that should be used on typical contracts. Items may be added and deleted as necessary to address the issues on any individual contract.

A link to the complete check list for the pre-construction conference agenda items can be found at: https://erms12c.indot.in.gov/fcrdocuments/ under FCR Documents.

The following entities should be notified of the pre-construction conference:

1. Contractor
2. District Construction
3. CO and District Design
4. Designer (if applicable)
5. Project Manager
6. Division of Construction Management
7. CO and District Utility Section
8. All involved utilities
9. CO and District Environmental Services
10. Permit Agencies (e.g. IDEM, USACE, IDNR when applicable)

11. District Materials and Tests
12. District Public Information
13. District Operations
14. District Safety.

For some of the above, the notice will be largely informational, allowing them to select the pre-construction conferences at which they wish to be represented. The following parties must also be notified when they have involvement in the project:

Local officials should be invited to INDOT pre-construction conferences if work will have an impact on their community.

1. FHWA (if not exempt from FHWA oversight)
2. County officials
3. Municipal officials
4. Designer
5. District Local Programs Coordinator
6. District Environmental Scientist
7. Railroads
8. Affected industries.

On contracts where the pre-construction conference may be lengthy and the attendance large, the meeting should be scheduled so matters of interest mainly to the State and Contractor may be discussed after other representatives have addressed their concerns for the project and have been given the opportunity to leave the meeting.

At the pre-construction conference, lines of authority for all parties involved in the work should be clearly defined and determinations made as to notifications in emergencies. The Contractor should be advised as to the authority of the PEMS on the contract, compliance with specifications, and that cooperation will be expected. The Contractor must be prepared to submit the required contract schedule at the meeting. An effort should be made at this time to coordinate the Contractor's schedule with utility schedules, permit schedule restrictions, and with the interests of others affected by the construction. All problems cannot be resolved or even anticipated at the pre-construction conference but known problems should be recorded at this time so that progress towards early solutions can begin.

On Federal aid projects, the contract EEO requirements should be discussed. Attention should be directed to the required posters, equal opportunity employment practices, payroll requirements, including the three-year preservation clause, and that subcontractors and temporary plant operations are governed by the same regulations as the prime contractor. On State funded projects, the discussion of MBE, WBE, and IVOSB requirements for the project must take place.

The Contractor shall be responsible for electronically submitting certified payrolls for their employees and any subcontractors to the PEMS on a weekly basis. The filing shall utilize the Department's CPMS application. Failure of the Contractor to submit a payroll in a timely manner may result in the withholding of progress estimates until the certified payroll is properly submitted.

Environmental concerns should also be discussed at the pre-construction conference. INDOT Environmental Services has developed a checklist for use by the District and PEMS. The checklist is included for informational purposes and is located in 2.5.1. It is primarily the responsibility of the PEMS to ensure that the Contractor has properly implemented and maintained the stormwater management plan and other requirements of all waterway permits acquired. The PEMS should consider utilizing stormwater specialists and environmental managers within the District or INDOT Environmental Services at Central Office for additional information on proper placement, implementation, and maintenance of stormwater management features if questions arise. Reference should also be made to 3.1.

If there are any questions or difficulties in the identification of such features for specific projects, Construction Management should be contacted in advance of the pre-construction conference.

Minutes of the pre-conference must be kept and copies provided to all those in attendance within three business days. Minutes must be included as an attachment to AWP.

2.5 INITIAL DUTIES OF THE PEMS

Listed below are some of the first duties of a PEMS upon being assigned to a project.

(a) Before entering upon any property, check to see if the ROW has been secured and the Department has a right of entry. The special provisions of the contract should state this information. ROW has not been secured for any parcel, instruct the Contractor and assigned project personnel not to enter the parcel.

(b) Determine from the plans whether or not a detour will be required during the construction of the contract. If it is required, check the plans against the standards to ensure that all required route markers, signs, and barricades will be correct and in place before traffic is detoured.

(c) If construction engineering is not a part of the contract, run the centerline and set the grade stakes, as specified under Section 3.4 Staking and Construction Engineering of these instructions, as soon as possible after assignment to the project. This is necessary in order to allow the property owners, utilities, etc., as long a time as possible to move their fences, buildings, pole lines, etc. If the contract has not been awarded, stakes can be secured from the DO, a count being kept of the number of each size obtained so that the Contractor can “repay” with like number and kind during the life of the contract, as the Contractor is required to furnish all necessary stakes.

(d) Approximately ten days before the monuments are to be set, the County Surveyor is to be contacted by the PEMS and given the opportunity to be present during placement or to check the monument shortly thereafter. The PEMS should document on the daily report any details in regard to monuments and with respect to contacts made with the County Surveyor.

The preservation of corners is vital. Failure to take care of this feature of the work is unacceptable.

(e) Start early to locate all farm drain tiles as this is a slow process and requires perseverance. Contact all property owners and enlist their help in locating farm drain tile on their property.

(f) Work with the AE to see if there are any utility or railroad agreements pertaining to the project. Keep in close contact with the utilities and railroads so they can be kept up to date of construction progress and plans and stay in coordination with the Contractor's work.

(g) Note any mailboxes that will need to be replaced either permanently or temporarily due to the project.

(h) It is essential that the Contractor provide a suitable office for the PEMS as soon as possible. The PEMS should review the proposed office location for safety, security, parking, and accessibility prior to approval. The office size should also be reviewed for compliance with contract provisions.

(i) Other State and Federal agencies have areas of concern that fall within contract limits. This is particularly true where rivers, streams, wetlands, ponds, lakes, floodplains, or other drainage features are concerned. By law, these agencies have extensive permit and approval powers over construction wherein hydraulics, the environment, or ecology is concerned. In many cases, when designers prepare plans for a contract, they included features necessary to secure such permits or agreements. For this reason, it is vital that construction of the contract be accomplished in accordance with the plans. IDEM permits, USACE permits, and IDNR permits are available on the Department's website to ensure that contract staff are aware of special environmental requirements. The PEMS should review all preliminary engineering reports and environmental documents prior to the pre-construction conference. The PEMS should also be familiar with and utilize the Department's Stormwater Management Field Guide and IDEM's Storm Water Quality Manual. In the event the plans have not addressed any conditions of those special documents or if field conditions appear to have not been properly addressed regarding environmental concerns, the PEMS should contact the AE for guidance on making any necessary changes. The District Stormwater Specialist, District Environmental Scientist, the Division of Construction Management, and the Environmental Services Section can also provide assistance. Changes to the contract work that may violate the environmental requirements are not permitted without submittal and review by INDOT Environmental Services and approval from the appropriate authorities.

(j) The Contractor shall prepare a Materials Source List for the contract. It shall be submitted at the pre-construction conference.

(k) On all contracts involving Federal participation, specific forms are required to be placed and maintained on an all-weather bulletin board. The FHWA website at: https://www.fhwa.dot.gov/programadmin/contracts/poster.cfm identifies these forms.

All the forms, except the Contractor's EEO Policy, will be available from the DO for contract distribution. The Minimum Wage Determination document will be referenced within the CIB. It is the DO EEO's responsibility to see that the Contractor is adequately supplied with the required forms and that copies of each, plus the Contractor's EEO Policy, are properly posted, by the Contractor, in a conspicuous location on the contract.

(l) The PEMS shall prepare Form IC-662, Report of Crop Damage, when a crop is actually destroyed. This report should be prepared and submitted as soon as practical after a crop has been damaged and it should show sufficient dimensions to compute an exact acreage.

(m) If an accident occurs on a contract, the PEMS will contact the police agency involved to obtain an accident report.

(n) Accident reports need to be reviewed to determine if recurring problems require changes to the current traffic control plan. The accident reports should be scanned and included with the daily report for the date of the accident.

(o) The Contractor must identify and submit for approval the location of all borrow and waste disposal sites. The PEMS must review the submittal for compliance with the specifications. Form IC-203, Request for Acceptance of Borrow or Disposal Site, is available on the Department's website and must be completed by the Contractor for each proposed site. The PEMS must review and sign the form if approved. Questions about borrow or disposal sites should be directed to the AE.

2.5.1 PEMS Environmental Services Permit(s) Checklist

The checklist has been developed to help support project delivery and keep the project in compliance with environmental requirements.

Before PRE-CONSTRUCTION CONFERENCE

PEMS initial permit review

1. Locate project specific permits and commitments online.
2. Print or download and store permits and review conditions that must be followed during construction.
3. Note on the plans any identified waterways or areas of special concern and areas with commitments.
4. Note the name of permit applicant (INDOT or LPA for non-INDOT projects) and contact number or email.
5. Contact the permit applicant (INDOT or LPA) with any questions/concerns or proposed revisions to the permits.
6. Discuss any questions or concerns with the District Stormwater Specialist.

During PRE-CONSTRUCTION CONFERENCE

Discuss expectations for permit compliance including:

1. Permits and commitments with the Contractor and document any conflicts with the plans or the contract.
2. Compliance with all permit conditions is required during construction.
3. Offsite movement of sediment violates multiple waterway permit conditions.
4. Permitting procedures for offsite borrow and waste areas; because these are off the ROW, local requirements need to be followed by the Contractor.

Discuss issues related to permit modifications/waivers that may be needed including:

1. Communicate any modification/waiver needs to the permit applicant. All modification requests must be made through ES for INDOT contracts. Potential Contractor permit modifications/waivers may include temporary impacts (stream crossings, causeways, pump-arounds), waivers (fish spawning, Indiana Bat tree clearing restrictions), additional temporary or permanent impacts inside or outside of the construction limits, IDEM Notice of Intent (NOI) amendment, etc.
2. Sequencing project construction phasing with the SWQCP.
3. Documentation and notification requirements of changes in the SWQCP.

4. Allowing time for processing by ES and regulatory agencies. This process may take several weeks or longer.

Discuss utility companies' responsibilities for environmental compliance and permitting impacts related to their work.

<u>During CONSTRUCTION</u>

Contractor's Initial operations (clearing/demolition)

1. Post all permits on the bulletin board prior to the start of construction.
2. Install perimeter control measures prior to land disturbing activities.
3. Install any needed temporary stormwater management measures for clearing/demolition.

Contract Permit impacts

1. Understand the contract permit conditions and the permitted stream/wetland/pond/lake/floodplain/habitat impacts. ES should be contacted for permit questions.
2. If conditions indicate work will overstep the contract permit requirements and permit modifications are necessary, the PEMS must contact ES.
3. PEMS should spot check off-site borrow/disposal areas for permit compliance.
4. WHEN REQUIRED, comply with Indiana Bat tree clearing restrictions (no clearing April 1 - September 30).
5. WHEN REQUIRED, comply with fish spawning season restrictions (no in-stream work April 1 - June 30).
6. Direct questions/concerns during construction to permit the applicant (INDOT or LPA).

Storm Water Management

1. Perimeter control measures should be in place prior to land-disturbing activities.
2. Focus should be on erosion control measures first (these measures are less expensive and more efficient); sediment control measures should be a secondary focus (these measures are more expensive to install and are less efficient).
3. PEMS should spot check weekly/rain event inspections reports provided by Contractor for accuracy.
4. Properly track slopes in accordance with 203.09 of the SS.
5. Ensure the stormwater management measures used are correctly installed and maintained in accordance with the SS and Standard Drawings.
6. Modify the SWQCP as needed to meet field conditions, and, if needed, consult District Stormwater Specialist or Central Office Environmental Services Stormwater team for assistance.

7. Review the Contractor's schedule for completing earth disturbing activities and establishment of the required 70% permanent vegetation for reasonableness.

Permit violation response (if necessary)

1. Coordinate with permit applicant (INDOT or LPA).
2. PEMS and the Contractor should prepare a formal response detailing corrective action for all violations (CSGP, etc.).

Mitigation site construction

1. Construct the site as per project plans and communicate any recommended changes to the plans with the permit applicant (INDOT Environmental Services or LPA).
2. Direct questions and concerns during construction to INDOT Environmental Services for resolution.
3. Contact INDOT Environmental Services for plant material concerns or issues.

PREFINAL

Inform District Stormwater Specialist and INDOT Environmental Services of Prefinal for discussion of:

1. Construction of the contract according to the plans including all compensatory mitigation or restoration areas.
2. NOT requirements.
3. When site inspection reports should end.
4. Final plant material inspection and acceptance.
5. Requirement of 70% uniform, permanent vegetation density.
6. Removal of temporary stormwater management measures and area stabilization.

RESOURCES

IDEM Emergency Response
Phone: (317) 233-7745
Toll Free: (888) 233-7745

Indiana Storm Water Quality Manual
(https://www.in.gov/idem/stormwater/resources/indiana-storm-water-quality-manual/)
Chapter 7: Storm Water Quality Measures: Construction & Land-Disturbing Activities.
Description: IDEM publication that provides the purpose, specifications, installation guidelines, and maintenance guidelines for storm water management. This chapter also includes information on stabilized construction entrances, secure concrete washouts, and stream crossings.

USGS Topographic Maps
(https://apps.nationalmap.gov/viewer/)
Description: USGS maps can be used when evaluating an area for potential streams (solid or dashed blue lines).

INDOT Links
INDOT Request for Acceptance of Borrow or Disposal Site (IC-203).
(https://erms12c.indot.in.gov/fcrdocuments/)
Description: The contractor is required to complete this form for any off-site borrow or disposal site. It includes what permits, if any, have been obtained by the contractor and whether or not the site has been cleared of wetlands and archaeological resources.

INDOT Environmental Services
Ecology and Waterway Permitting Office
(https://www.in.gov/indot/engineering/environmental-services/ecology-and-waterway-permitting/)
Description: The tasks assigned to this section are summarized on this webpage as well as links to Ecology & Waterway Permitting Staff and Permitting Guidance.

2.6 CONSTRUCTION PROGRESS

It is the intent to allow a reasonable length of time for completion of all contracts. If the Contractor overruns the completion date, they are charged a flat rate per day as liquidated damages in accordance with the SS or as established in the contract.

The Contractor must furnish an acceptable project schedule in accordance with the SS. The schedule should be discussed at each progress meeting and updated by the Contractor as necessary. It is important that the PEMS review the schedule to ensure that it accurately reflects the activities required and in the order in which they will be accomplished.

2.7 SUBCONTRACTS AND RENTAL/LEASE AGREEMENTS

2.7.1 Subcontracts

A prime contractor may subcontract the work in accordance with current Federal Regulations and SS. The SS state that only when consent is given, can the Contractor sublet a portion of their work. The Contractor is required to perform no less than 50% of the original or revised contract amount, whichever is less. The SS state that all specialty items of work may be performed by a subcontractor and that those approved subcontractors will not be permitted to further subcontract their work.

All subcontract requests must be sent to the DO EEO for approval. To obtain approval of a proposed subcontractor, the Contractor must formally request subcontractor approval by submitting the information in the Department's SiteXchange application.

There must be a written and executed subcontract agreement between the Contractor and the subcontractor. A copy of the subcontract agreement must be on file in the offices of the

Contractor and the subcontractor. On Federal-Aid contracts, a set of the applicable Federal Wage Stipulations, Notice of Requirement for Affirmative Action, EEO Special Provisions, Form FHWA-1273 (Federal Contract Provisions) and all applicable contract special provisions pertaining to the subcontractor's operation must be physically attached to and become a part of the agreement. These documents must be made available for review by appropriate Department or FHWA personnel upon request. If subcontractor approval is not obtained prior to that subcontractor working, any work performed by the subcontractor will be considered as unapproved work and should not be paid.

Subcontracting and the timely submission of requests must be a subject for the pre-construction conference.

2.7.2 Field Control of Subcontractors

A subcontractor should not be allowed to start work on the project until approved by the DO EEO. The PEMS may request a verbal approval of the subcontractor from the DO EEO and allow a subcontractor to work prior to the SiteXchange Request for Subcontractor Approval. **Failure to follow the processes described below places the Department's federal funding at risk**.

When a change order adds new pay items of work which are to be subcontracted, the PEMS must get approval from the DO EEO. If the approval is verbal, it shall be documented and attached in AWP with the change order.

Department DO EEO personnel are responsible for monitoring the EEO requirements for DBE, MBE, WBE, and IVOSB programs. Since the achievement of specific DBE participation on Federal-aid contracts is mandated by Federal Regulation, it is necessary that persons at all levels become familiar with these instructions.

Emphasis on the utilization of subcontractors requires that special care be taken by the Department's DO EEO personnel to ensure that the DBEs are being utilized and are performing as set out in the contract proposal. The specific sheets in the proposal are identified as "Affirmative Action Certification." On all Federal-Aid contracts, the Contractor is required to list in the proposal those DBEs intended to be utilized to satisfy the DBE Goal stated in the CIB.

The fact that the Contractor lists specific DBEs in the proposal obligates them to use the DBEs to the extent listed under the contract and for the dollar value indicated in the Affirmative Action Certification. The PEMS must review the items being performed by the DBE to see that they are consistent with the subcontract agreement information within AWP. Information on DBE and subcontractors can be found within the Subcontractors top heading in the Administrative Summary for contracts. NO CHANGES OR ADJUSTMENTS TO DBE ITEMS ARE PERMITTED UNLESS ACCEPTED BY THE DEPARTMENT THROUGH THE DBE CHANGE IN UTILIZATION PROCESS.

Written consent will be provided by the Department based on the Contractor meeting the requirements outlined in 49 CFR 26.53, Department policy, and the SS. The Contractor is required to make good faith efforts within seven business days of Department consent to obtain additional DBE participation. At the end of the contract, the Contractor shall be required to certify actual utilization of the DBEs listed in the proposal. If the Contractor cannot certify full utilization of DBEs for the items listed and for the dollar values indicated in the Affirmative Action Certificate, they must provide a satisfactory explanation why their commitment was not reached. The Department must monitor the process carefully to see that proper payment is made.

With this in mind, the topic of subcontractors, particularly DBE contractors, must be an important topic of the pre-construction conference. A discussion with the Contractor and the DBE subcontractor, if possible, must be in sufficient detail so the DO and the Department's contract personnel understand what work the DBE will be performing. If the DBE is to do an entire contract item, the DBE is required to perform that work with no work on the particular item by the prime contractor or others. If on the other hand, the DBE is performing only a portion of a contract item, then a detailed discussion must be conducted to explain exactly what portion of the item will be performed by the DBE.

Any deviation from performing an entire contract item must be explained on the SiteXchange Request for Subcontractor Approval. Whether the DBE is performing an entire item or only a portion, no work of any nature on the specific item may be done by anyone, including the Contractor, prior to subcontract approval by the DO. Since the PEMS will be on the contract site to observe the Contractor and their approved subcontractors, it is absolutely necessary that the PEMS knows who is performing what work on the contract. If any item is not being performed as set out in the proposal, all work on that item must be stopped, unless there is immediate danger to life or the traveling public, until a proper approval or explanation is received.

All subcontracts must be approved by the DO EEO before the subcontractor can be permitted to start work. Although some isolated verbal approvals may be given for DBE subcontractors, the Contractor should be encouraged to submit subcontract requests early, especially if the DBE is doing portions of an item which will require additional explanation. The PEMS will not permit any other person, whether it's the Contractor's staff or another subcontractor, to perform an item which has been designated by the Contractor for a DBE.

If for any reason the Contractor finds that a DBE subcontractor will not, or cannot, perform designated work as proposed, the Contractor must notify the Department using the Change in Utilization process. These changes also include those made by Department personnel. Since all subcontracts must be approved by the DO EEO, the Contractor cannot arbitrarily delete items of work from the DBE or switch items to themselves or any other subcontractor, without first obtaining approval. The approval to change or substitute subcontractors will be processed by the Department. All requests for changes from the original listing in the proposal must be submitted in writing and follow the Change in Utilization process.

On all Federal Aid contracts, EEO Attachment CM 32-34, signed by the proposed subcontractor, must be submitted with the subcontractor approval request.

The Contractor is required to provide the Director of the Office of Federal Contract Compliance Program (OFCCP) notification in writing, with a copy to the Department, of each subcontract they award in excess of $10,000.00. This notification shall include the name, address, telephone number, and employer identification number of the subcontractor. It shall also contain a contract number, type or nature of work to be subcontracted, the subcontract dollar amount, the geographical area in which the work is to be performed, and the estimated starting and completion dates.

The notice shall be forwarded to the Assistant Regional Administrator, Office of Federal Contract Compliance Programs, U.S. Department of Labor, 429 N Pennsylvania Street, Indianapolis, Indiana 46204, within ten (10) working days of the award of each subcontract by the Contractor. The Contractor, in their letter to OFCCP, may wish to indicate that the subcontract has been awarded, subject to the approval of the Department. The Contractor shall submit a copy of the notification with the SiteXchange Request for Approval of Subcontractor in addition to the required Attachment CM 32-34.

The Department will not give approval of the Request for Approval of Subcontractor unless accompanied by the OFCCP notification. No work shall be performed by the proposed subcontractor until DO approval has been given.

Subcontractor approvals may occur prior to issuance of the Notice to Proceed, but no work shall begin until the Notice to Proceed has been issued.

The DO is to emphasize to the Contractor at the pre-construction conference that all sublet requests should be submitted as soon as possible. Also, contractors are to be reminded that all requests must be submitted through the DO. All subcontract requests shall be accompanied by a Certification of Unearned Work, IC-108, completed by the subcontractor and kept in the Contractor’s files.

When the dollar value of the subcontract request exceeds $300,000.00 or the unearned work certificate exceeds $300,000.00, the proposed subcontractor must be pre-qualified with the Department. Pre-qualification is not required for hauling operations or for construction engineering work. All subcontractors must be approved by DO EEO even though pre-qualification may not be required.

2.7.3 Rental/Lease Agreements

The purpose of a Rental/Lease Agreement is to allow the Contractor to rent or lease a piece of equipment.

The Contractor or subcontractor is permitted to rent or lease equipment from other contracting firms or rental agencies as long as there is appropriate rental/lease agreement. The agreement cannot contain any provisions that might cause it to be construed as a subcontract agreement. Such an agreement would be in violation of the contract.

The difference between a subcontract and a rental/lease agreement is that a subcontract will stipulate items of work by unit of measure such as: EACH, TON, CYS, LFT, etc., along with specific quantities and unit prices. A standard rental/lease agreement will stipulate the basis for payment as an hourly, weekly, or monthly rate for the rental of equipment or trucks (with or without operators).

If the operator is provided by the Contractor or subcontractor, the operator must be paid directly by the Contractor or subcontractor. If the operator is provided with the equipment, the operator must be paid by the lessor.

The rental/lease agreements could cover such items as traffic control devices, trucks, equipment (with or without operators), etc., and the agreement must be signed by the parties involved and shall contain a statement that this is the only agreement that exists between the parties.

The PEMS will need to secure copies of the rental/lease agreements from the contractor or subcontractor. A copy of the rental/lease agreement must be sent to DO EEO. Any time there is a need for a rental/lease agreement on a project, an agreement must be secured.

If the PEMS or DO EEO suspect a problem on the contract due to a rental/lease agreement with any Contractor, subcontractor, lessee or lessor, including non-DBE's, the PEMS or DO EEO has the right to request and receive the agreement for review. The PEMS or DO EEO should make the request through the Contractor.

Payrolls are required to be submitted by the Contractor through the Department's CPMS when work on a rental/lease agreement is covered by the Davis Bacon Act.

The PEMS and DO EEO must review the agreement upon receipt to determine if it is a standard rental/lease agreement. If it is, retain the agreement in the contract file. If the agreement contains any provisions that seem beyond the scope of a standard rental/lease agreement, it is to be forwarded to the DO for review and interpretation. When the PEMS becomes aware of an obvious violation, the Contractor is to be instructed to stop the operation involved until the violation is corrected.

All contracts contain an RSP that requires the Contractor to provide the Engineer, including DO EEO, copies of any lease agreements between DBE trucking subcontractors and any DBE, or non-DBE trucking firms, or owner/operators that will be used to supplement the DBE trucking subcontractor's trucks for the purpose of meeting the DBE goal. Copies of these lease agreements shall be provided by the time of use of any supplemental trucks on the contract.

Questions that the PEMS may have on the issue of rental/lease agreements or payrolls related to rental/lease agreements should be addressed to the DO EEO Officer.

The following chart is being provided for added guidance.

Lease Agreements Between	Documents Required Yes/No		
	Lease Agreement	Certified Payrolls Davis-Bacon Act Work	Certified Payrolls Non-Davis-Bacon Act Work
Prime and DBE Lessor	Yes	Yes	No
Prime and Non-DBE Lessor	Yes	Yes	No
DBE Subcontractor and DBE Lessor	Yes	Yes	No
DBE Subcontractor and Non-DBE Lessor	Yes	Yes	No
Non-DBE Subcontractor and DBE Lessor	Yes	Yes	No
Non-DBE Subcontractor and Non-DBE Lessor	Yes	Yes	No
DBE Lessor (1) and DBE Lessor (2)	Yes	Yes	No
DBE Lessor (1) and Non-DBE Lessor (2)	Yes	Yes	No
Non-DBE Lessor (1) and DBE Lessor (2)	Yes	Yes	No
Non-DBE Lessor (1) and Non-DBE Lessor (2)	Yes	Yes	No
Hauling Lease DBE	Yes	Yes	No
Hauling Lease Non-DBE	Yes	Yes	No

2.7.4 Subcontractor Payment Tracking System

Standard Specification 109.07 requires the Contractor to pay all subcontractors, including lessors and material suppliers, for the value of all work performed and all materials complete in place within 10 business days of being paid by the Department.

By the 10th of the month following the payment, the Contractor is required to report all payments made to subcontractors. Additionally, on federally funded contracts, the Contractor must report payments made to all DBE brokers, haulers, manufacturers, and suppliers approved by the Department. On State funded contracts, the Contractor must report payments made to all MBE/WBE/IVOSB brokers, haulers, manufacturers, and suppliers approved by the Department. Payments are reported through the INDOT Technical Application Pathway (ITAP).

By the 20th of the month following payment, subcontractors, brokers, haulers, manufacturers, and suppliers must verify payments in ITAP. If a subcontractor, lessor, or material supplier thinks that payment has not been made in the required time frame, or thinks there is a quantity error on a contract, they can submit an inquiry to Promptpayment@indot.IN.gov for investigation and resolution.

2.8 MAINTENANCE OF TRAFFIC DEVICES AND PAVEMENT MARKINGS

The proper and consistent arrangement of all maintenance of traffic devices is very important at all times. Therefore, the arrangement must convey the correct and appropriate information to the traveling public for the safe and orderly movement of traffic through the construction contract at all times. Poorly constructed, located, or maintained devices are a poor advertisement for the improvement, do not promote good public relations, and are a safety concern.

The SS, Standard Drawings, RSPs, and USPs indicate under what conditions various types of devices, including temporary barrier wall, and pavement markings are to be used. The contract plans indicate the various types of devices and markings that are applicable to the contract and the planned locations. However, the Contractor is responsible for the field layout, placement, operation, inspection, and removal of temporary traffic control devices and markings. The Contractor's Certified Worksite Traffic Supervisor, CWTS, certified by the American Traffic Safety Service Association, ATSSA, or approved equal, must direct all field layout, placement, operation, inspection, maintenance, and removal of temporary traffic control devices. The CWTS should attend the pre-construction conference to discuss maintenance of traffic issues.

A List of ATSSA Approved Equal Worksite Traffic Supervisor Certifications and Flagger Certifications is available at the Department's website. Any CWTS that has a current certification from ATSSA or one of the organizations in the CWTS category of this List will be considered to have met the requirements of the SS. Similarly, any flagger that has a current certification from ATSSA or one of the organizations in the flagger category of this List will be considered to have met the requirements of the SS. A copy of the CWTS certification, and flagger certification if applicable, should be requested by the PEMS.

The field layout will be reviewed by the PEMS prior to placement of temporary traffic control devices. A copy of the CWTS certification shall be provided to the PEMS prior to the start of the installation of temporary traffic control devices or if the CWTS changes. For contracts where no plans are furnished, the SS and SP should clearly indicate the requirements for the use and location of traffic control devices. The procedure prior to start of the work should be the same as previously outlined for contracts where plans are furnished. It is recommended the PEMS jointly inspect the first traffic control devices and setup for each phase with the CWTS and document the traffic control features. This documentation should list the type of device, location, date erected, date removed or relocated, contract item number, and other information pertinent to traffic control. A sketch showing the traffic control set up may be necessary to thoroughly explain the maintenance of traffic plan used.

Under section 801.03 of the SS, the CWTS is responsible for inspecting and maintenance of traffic features daily and completing a traffic control device report a minimum of once per week or whenever devices are installed, removed, relocated, or repaired. The CWTS is responsible for the completeness and accuracy of the Traffic Control Device Report, but the PEMS should verify that the Contractor is making a good faith effort to review maintenance of traffic features daily and completing and submitting an inspection report on a weekly basis. If the inspections are not being performed or the forms are not being submitted, liquidated damages may be assessed in accordance with 105.14.

Judgment should be exercised in the placement of advance warning signs to ensure adequate sight distance. Some variation in sign intervals may be required to obtain a safe and optimal sight distance. See the current Standard Drawings and MUTCD for appropriate placement of signs. The intent of requiring a CWTS is to ensure the Contractor takes responsibility for proper installation and maintenance of traffic control devices.

Advanced warning signs should be clearly visible or completely covered, as conditions require. These signs should be moved to more suitable locations when they begin to interfere with traffic changes. Traffic signs and devices should not be placed on sidewalks or trails.

Warning signs need to be located where they are most effective. There will be unique conditions that require special consideration which include:

1) whether the location is paved or conducive to the use of posts,
2) height of mounting, and
3) lateral distance from the pavement.

In general, the mounting height of signs and size of posts should be as shown on the Standard Drawings for signs and detours.

Sections of the SS call specific attention to the fact that all signs, barricades, temporary pavement markings, and other protective devices must be maintained in satisfactory condition at all times. Traffic control devices and pavement markings that are poorly maintained are often ignored by the traveling public and can create safety risks to both the motorist and the worker. The proper and correct construction, erection, lighting, and maintenance of all drums, cones, tubular markers, barricades, signs and sign standards, and pavement markings is the sole responsibility of the Contractor.

It is a responsibility of the PEMS to make regular work zone inspections for contract compliance. Furthermore, the PEMS should conduct a nighttime inspection of traffic control devices and pavement markings the first night after they are installed. This is especially true at the start of a phase when a lane is being restricted or a road closed. Traffic control devices and pavement markings that seem acceptable during daylight hours are often found to have deficiencies at night. The Contractor should be notified promptly so the deficiencies can be corrected prior to the following night. The PEMS should use the ATSSA brochure “Quality Guidelines for Temporary Traffic Control Devices and Features” as an inspection tool.

Temporary traffic control devices will be in non-compliance when considered “Unacceptable” in accordance with the ATSSA brochure. Temporary traffic control devices will be considered to be in non-compliance when 25% or more of an individual device is considered Marginal. Damages may be assessed in accordance with the SS for non-compliance.

Temporary pavement markings will be in non-compliance when they are considered “Unacceptable” in accordance with the ATSSA brochure, do not meet the visibility requirements of 801.12 of the SS, or have not been placed prior to opening to traffic. Damages may be assessed in accordance with the SS for non-compliance.

On open to traffic HMA pavements, edge lines are to be placed within 14 workable days and maintained until the next lift is placed or the permanent lines are placed, as appropriate for the situation.

On open to traffic PCCP, edge lines are to be placed within 14 workable days and maintained until the permanent lines are placed, as appropriate for the situation.

The Contractor must be immediately notified of any defects and advised of the corrective measures to be taken at once. Any deficiencies noted are to be entered on the Daily Report. The time and date the Contractor was notified, and when corrective measures taken should also be entered on this report.

Temporary Worksite Speed Limit Sign Assemblies are used in areas where the Contractor’s work causes a potential hazard, especially during lane closures. Enforceable reduced speed limits at worksites can be established without the Official Action process required for other speed zones. The design, placement, location, operation, measurement, and payment of such sign assemblies must be in accordance with the Standard Drawings and SS. Worksite speed limits are in effect when the lights are flashing. Such speed limits should not be used for the entire contract unless there is work in progress for the entire length. These speed limits are to be in effect only where and while work is in progress and workers are present. They should only be set up in an area where work is going to be performed. The maximum spacing is 2 mi. The CWTS is required to keep a daily record of the total number and location of signs displayed, using the roadway reference system, the area where each worksite speed limit is established, and the times they are established and discontinued.

On the signature sheet of the contract Invoice Voucher and Progress Estimate, a statement is included as to the condition of barricades, signs, detours, etc. If any of these items are not satisfactory, the estimate should be held at the project office until the unsatisfactory conditions have been corrected. A letter should be sent to the Contractor setting out the reasons for holding up the Progress Estimate with a copy to the DO and CO.

2.9 MAINTENANCE OF TRAFFIC

The RSPs and USPs for all contracts normally indicate whether the contract is to be closed to traffic, or whether traffic is to be maintained along the route. In some instances, the Contractor will be required to construct certain portions while maintaining traffic and other portions while closed to traffic. Upon assignment to the contract and receipt of the contract proposal, the PEMS should discuss thoroughly the requirements regarding traffic maintenance with the AE and the Contractor, or an authorized representative. This discussion should be conducted well in advance of the start of any construction operations in order to allow the Contractor ample time to make all necessary arrangements to erect the required barricades and standards.

Before starting work and when traffic signals are involved, the Contractor must provide the names and copies of each person's certification card of the Level II Traffic Signal Construction Technicians, the Level II Traffic Signal Field Technicians, and Work Zone Temporary Traffic Control Technician, who have been assigned to perform the signal related work. The certifications cards shall be issued by the IMSA (or an approved equivalent).

When portable signals are used, a technician, certified by the manufacturer, shall be available 24 hours a day to respond within 2 hours for the maintenance of the traffic signal equipment. A copy of the certification shall be provided to the PEMS prior to the placement of the portable signals. Appropriate vehicle detection, as indicated on the list of approved Portable Signals, shall be provided. A minimum of three drums shall be placed in front of the portable signal trailers for delineation.

The PEMS should conduct random checks to determine that traffic is moving efficiently and smoothly. There should be a clear understanding with the Contractor that their vehicles will strictly observe the movement of one way traffic and not be permitted to drive around a line of waiting cars and potentially into the path of oncoming traffic.

It is the intent of the Department to minimize interference with traffic from construction and maintenance operations during major holidays. To comply with the intent of this policy, the DCM may order, in writing, the suspension of work on individual contracts for specific periods of time.

2.10 MAINTENANCE OF TRAFFIC DURING WINTER MONTHS

Section 104.04(b) of the SS states that unless otherwise expressly provided in the contract, existing state roads and other public roads and streets within the limits of the contract shall be kept open to two-way traffic between the dates of December 1 and April 1. The SS further state that private drives and mailbox approaches which are disturbed by the Contractor and on which the surfacing has not been completed, shall be maintained in a condition satisfactory to the Engineer during the time work is suspended.

The PEMS must be thoroughly familiar with requirements outlined in the SS and any contract specific RSPs and USPs as they pertain to maintenance of traffic. The Contractor's attention should be called to those requirements, pointing out their responsibilities for the maintenance of traffic during winter months. This communication should be done sufficiently in advance of December 1st to ensure adequate time for completion of the surface and the necessary preparation for opening the contract to traffic on the specified date.

2.11 DETOURS

The PEMS should not allow demolition operations to begin on a road until the detour has been established and necessary warning lights, signs, and barricades have been properly placed by the Contractor, according to the plans and SS.

2.12 CONSTRUCTION ENGINEERING BY CONTRACTOR

These instructions are to be used on contracts which include the pay item of Construction Engineering. Construction Engineering is to be accomplished in accordance with the SS covering this specific pay item.

The primary purpose of the item of Construction Engineering is to accomplish the layout and setting of vertical control elevations utilizing the Contractor's personnel. The PEMS in charge of the contract will continue to be responsible for: determinations involving engineering judgment, measurement of pay quantities, inspection, serving as the point of contact for the public. The PEMS is also responsible for checking the accuracy of the Contractor's construction engineering as necessary. The degree of checking will vary from contract to contract. The construction engineering item of work is to be checked and inspected for quality of workmanship in the same manner as any other item of the contract.

The PEMS must check the original cross sections by plotting the elevations taken by the Contractor's crews every 500 ft for complete cross sections and every 100 ft on centerline. Structure locations should be checked after being staked by the Contractor. It is good practice for the PEMS to check lead dimensions and bridge grade elevations on all bridge contracts. If the Contractor's work is found to contain errors or inconsistencies, the PEMS must review these issues with the Contractor. Revised information must be submitted by the Contractor, at no additional cost to the Department, to properly correct erroneous or inconsistent information.

As pay items are completed for drainage structures and bridge structures, the quantities should be documented in the project files on standard Department forms.

Staking performed by the Contractor is to be performed in accordance with accepted surveying practices. Field notes shall be kept in a clear, orderly and neat manner consistent with standard engineering practices and in accordance with the Department's prescribed procedure. Field notes shall be furnished by the Contractor and shall adequately document all survey information. The field notes shall become the property of the Department upon completion of the work. The field notes may be inspected by the Department's project personnel at any time and should be regularly checked for completeness. Copies of field notes shall be furnished to the Engineer upon request during the contract.

The Contractor's work shall include:

1. re-establishing original survey points and survey centerlines,
2. referencing necessary control points,
3. running level circuits to check original benchmarks and setting additional benchmarks,

4. setting stakes for ROW, culverts slopes, subbase, subsurface drains, subgrade, paving, bridge footings, piers, and abutments, and
5. any other stakes required for control elevations such as footings, caps, bridge seats, and screed elevations.

The Contractor's personnel shall be used to locate all farm tile, supervised as necessary by the PEMS.

On road contracts, the level circuit to check the plan benchmarks will be run the full length of the contract. On bridge contracts, the circuit shall include four plan benchmarks, if available, two on each side of the structure.

After the grade stakes have been set for earthwork, the Contractor shall take an elevation on the top of each stake and tie in such elevation to a permanent plan benchmark. At the same time, the Contractor shall take a complete cross section at each 500 ft and centerline elevation every 100 ft. Using this information in conjunction with the plans, the Contractor shall prepare a grade sheet including necessary information for special ditches.

In the staking of culverts, the Contractor shall perform appropriate checking to establish the proper location and grade to best fit the conditions on the site. The PEMS will make a cursory inspection to verify the Contractor's work. Any revision of plan length or size of culverts is to be approved by the PEMS. The Contractor does not have the authority to revise planned culvert information.

The bid price for the item of Construction Engineering is on a lump sum basis. The payment for this item on a Progress Estimate is to be made in proportion to the percent of the contract completed. This may be done by estimating the percent complete and should not require extensions of all pay items for the Progress Estimate being prepared.

It must be stressed that the Department's Engineer will make all measurements and surveys that involve the determination of all final pay quantities.

The following points should be re-emphasized:

(a) Department personnel will make all measurements and surveys involving the determination of final pay quantities, including earthwork.
(b) The PEMS is responsible for determinations involving engineering judgment.

The efficiency and satisfactory results obtained from the use of construction engineering will depend largely upon a high degree of cooperation between the State and Contractor personnel.

The use of GPS, controls for construction engineering and machine controls must provide adequate staking necessary for the PEMS to check the accuracy of the work. The extent of use for GPS should be discussed at the pre-construction conference.

2.13 WAGE RATE PROVISIONS ON FEDERAL-AID CONTRACTS

As a condition of Federal participation in highway projects, the Department and its representatives are responsible for the enforcement of the Federal labor standards as set out in the CIB. In this respect it is the responsibility of the PEMS to make frequent examinations of the contractor's employment records within the Department's CPMS, which by the terms of the contract are required to be made available at the site of the work during the progress thereof. Such examination shall establish (1) whether the wages being paid to laborers and mechanics are at rates not less than those predetermined by the Secretary of Labor as contained in the contract provisions; (2) whether the work being performed by any specific class of employee, including helpers and apprentices, conforms to the classifications set forth in said contract provisions for the wage rate they are being paid; and (3) whether the classifications are correct and whether there is evidence of any disproportionate employment of laborers, helpers or apprentices as to indicate avoidance of the minimum wage rate provisions of the contract; and (4) that payrolls are received timely on a weekly basis.

2.13.1 Wage Rate Interviews

Systematic spot interviews are to be made by the PEMS and/or the DO EEO Officer with the employees of the Contractor or subcontractor on the job to establish reasonable assurance that the minimum wage rate provisions are being fully complied with and that there is no misclassification of labor or disproportionate employment of laborers, helpers, or apprentices. Employee interviews should be made early in the life of the contract and whenever changing operations bring in an influx of new employees. Most violations in the past have been occasioned by groups coming in from other areas where different wage rates prevail, and their supervisors not informing themselves as to the required scale. Employee interviews should be documented. The responsibility for seeing that sufficient interviews are made to ensure that minimum wage scales are being met, rests with the PEMS, but this does not preclude the delegation of the duty to a responsible subordinate nor does it preclude such interviews being made by AEs, and they are encouraged to continue interviews where they have been so doing.

2.13.2 Contractor Payroll Management System (CPMS)

The CPMS process helps the PEMS identify and act on these issues. The CPMS application is located within the INDOT Technical Applications Pathway, ITAP.

Once within the CPMS system, the PEMS will be presented with a summary screen of the contracts they have authority on organized by District. Within the summary, there are columns indicating Payrolls Submitted, Payrolls, Upcoming, and Payrolls Overdue. To view a specific Contractor's Payroll, select the appropriate Contract # from the Summary. Once the contract is viewable, CPMS lists all the approved Contractors on the contract and which weeks those contractors had personnel on-site, based on DWR entries. The PEMS can manually override a week's Payroll Required state in case contractors were on site but not recorded by the HT.

Payroll uploads by the Contractor are visible for any week. The PEMS can review payrolls, in accordance with the CPMS Manual instructions, and either Approve or Deny their compliance. Payroll blocks will turn either green or gray accordingly.

Federal-Aid projects provide for the optional use of form WH-347 for the submission of weekly certified payrolls. The information for the payrolls may be submitted on the optional WH-347 or in any other format desired. The weekly submission of a properly executed certification, as set forth on the reverse side of the optional WH-347, will satisfy the requirement for submission of the “Statement of Compliance. Detailed instructions of the contractor’s responsibility in regard to payment of fringe benefits are given on the back of Form WH-347. All PEMS or others responsible for checking contractor’s payrolls should use these instructions as guidelines when checking payrolls.

Drivers of bona fide independent trucking firms who make deliveries to the construction site for, or on behalf of, either a contractor or the materials supplier are not subject to the wage requirements provided the source or supplier is an established commercial supplier.

A trucking firm does not need to have an established published tariff in order to be considered a “common carrier.” The exception set out above is applicable only if the source is a recognized commercial source; and would not apply to temporary sources or production by the contractor or a subcontractor. In view of this interpretation, it will be necessary to question the transportation feature when a contractor is purchasing material FOB supplier’s plant or source to determine whether or not the truck drivers are subject to the minimum wage rates. Even though there has been a prior determination by that a source or supplier is considered commercial and the production not subject to the minimum wage rates it will still be necessary in each subsequent instance to determine the purchase arrangements, FOB. source or FOB job site, to determine the status of the truck drivers.

Anytime that material is purchased FOB a commercial source, it will be necessary to differentiate whether the drivers are employees of the contractor or a bona fide independent trucking firm. An owner-operator or trucks rented by the contractor would not be considered an independent trucking firm. As a guideline, an independent trucking firm would be any company that normally contracts the hauling of batches or like materials from the prime contractor, and thus assumes the responsibility to perform that particular operation.

2.14 FIELD OFFICE

The purpose for having a field office is to provide Department field staff a place to work on office details of construction engineering, reports, and required records for the job. Meeting the general public at a field office may be limited, but this purpose should not be forgotten in its maintenance, furnishing, and location. The location of the field office will be approved by the PEMS. The field office and equipment must be complete with all utility and equipment requirements as noted in accordance with 628 of the SS.

Due to the possibility of vandalism or loss by fire, one of the first considerations in the location of the office should be safety from these hazards. Generally, a more populated, lighted, or police patrolled area will be safer than one in which none of these conditions exist. For these reasons consideration must be given to locating the office in a village or town as compared to a more remote area along the highway. Convenience to a job and safety to the traveling public must be considered. The office and a logical parking space should be located so that neither is on public right of way and within 30 ft of the edge of pavement lanes open to traffic.

Cleanliness and orderliness should be kept in line with the purpose of conducting the business of the Department. A clean and neat office is conducive to a business-like atmosphere and creates a lasting impression in the mind of everyone having occasion to enter. Wall decorations, which would be considered in poor taste in any public building, reflect poorly on the PEMS and staff when found in a field office and are not permitted.

The equipment furnished in the field office is for Department business only. If the field office is used to supervise more than one contract, terms shall be agreed upon prior to use for additional contracts.

Payment for the field office should be continuous from the start of the contract until the work is completed. This would include the months that the contract may be suspended over the months. The exception to this procedure is stated in 108 of the SS.

2.15 PARTIAL PAYMENT FOR STOCKPILED MATERIALS

Items listed in 111 of the SS can be considered for partial payment for stockpiled materials when the allowable partial value for a given pay item exceeds $50,000.

The PEMS must substantially verify and document the quantity of materials reported by the Contractor in the construction applications program. The quantity of materials should be reported in the same units as shown in the CIB, for example, subbase should be shown in units of CYS, riprap in TON, and dowel bar assemblies in LFT.

A change order will need to be processed to establish an item for each stockpiled material. Payment would be authorized up to the verified amount. The unit cost should not exceed the allowed percentage of the original unit price in the contract documents. The PEMS must approve the storage location, assure that the materials are accessible in the event of Contractor default, and note the item being stockpiled in the supplemental description of the change order. Lump sum items should be created as a whole lump sum quantity with a unit price prorated to match the verified quantity. For example, a PEMS will create a lump sum stockpiled material item for Structural Steel with a unit price of $100,000. The steel is planned to be stored at the manufacturer’s facility. The stockpiled material lump sum quantity would be 1.00. The price would be calculated as:

$100,000 (contract unit price) x 70% (maximum percentage based on storage location) = $70,000.

As an alternative to the above described change order process, the PEMS could choose to generate a $1.00 unit price for each stockpiled material item and list each stockpiled material item on the change order. As partial payments are made for each stockpiled material and then deducted, as those materials are completely incorporated into the work, the $1.00 value of each stockpiled pay item generated on the change order will increase and then, ultimately, decrease to arrive back at the original $1.00 unit cost.

The PEMS will be required to attach all the required documentation, such as delivery invoices in accordance with 111 to the change order as the stockpiled material payments are made. Attaching the required documentation to the change order provides proof that the Department has ownership of the specific stockpiled material. The explanation of the change order should describe each pay item to be stockpiled whether the material is stockpiled on the jobsite or other approved storage facility, the maximum partial payment percentage used for each item material in accordance with 111, and the corresponding maximum dollar value of each stockpiled pay item. The maximum dollar value is calculated using the equation:

Maximum Dollar Value = (maximum percentage based on the storage location) x (contract original item cost)

This alternative method of making payment for stockpiled materials through a change order allows the Department to track the payment of the stockpiled materials with approved stockpiled material pay items and may simplify the change order approval chain. Stockpiled material items created this way are not intended to increase the overall contract value. The change order generated items for the stockpiled materials are used temporarily and are intended to only pay for the initial stockpiling material costs. This option supports both the accounting for payment~~s~~ and the change order policy.

Change orders considered by the PEMS for stockpiled materials in which the Department has determined there is a material shortage, must be agreed to by the AE and their Districts FE prior to generation.

The PEMS or their delegate shall make frequent inspections of the stockpile to assure the materials are not being used for other work unless authorized in writing by the DDC. If stockpiled materials are used without prior authorization, progress payment amount will be deleted from the next estimate.

2.16 EQUAL EMPLOYMENT OPPORTUNITY
All Federal-Aid contracts contain some type of EEO requirements. These requirements differ from contract to contract. It is essential that the PEMS carefully examine the provisions of the contract to better understand which requirements are applicable. It is the PEMS responsibility to maintain a complete and accurate file of all EEO documentation required for the contract.

The following is a list of various types of EEO documentation; some or all of which may be required on a specific contract:

1. Minutes of pre-construction conference and/or EEO conference, if held separately.

2. Record of visits of the Contractor's EEO Officer on the contract to review EEO compliance.

3. Records of meetings of the Contractor's supervisory personnel.

4. Copy of the EEO Policy statement with EEO Officer appointment letters for the Contractor and all active sub-contractors.

5. Copy of the EEO Bulletin Board form listing the required posters for the project.

6. Statement from the Contractor that the notation "An Equal Opportunity Employer" will be used in all advertisements for employees.

7. A list, prepared by the Contractor, of the area minority group organizations which they intend to contact as a potential source likely to yield minorities for referral to the contract for employment, as the need for personnel arises and when it does not violate a bargaining agreement.

8. Records of payroll.

9. Records of any complaints of discrimination and actions taken.

10. Statement from the Contractor indicating if pre-apprenticeship, and on-the-job training are being used on the contract.

11. Statement from the Contractor that they are reviewing, at a minimum of every six months, all employees on the contract for training and promotion.

12. Records indicating minority contractors and/or organizations contacted that might yield potential minority subcontractors in the Contractor's efforts to utilize minority subcontractors. This is not required if there are no subcontractors.

13. List of all unions, which furnish employees for the contract.

14. Name of unions, which do not have EEO clauses in their agreements with the Contractor or its representative.

15. Copies of letters to unions informing them of the Contractor's EEO policies and the goals to include minority and majority persons in the performance of this contract.

16. The name, address, and telephone number of the EEO Officer for the Contractor and all subcontractors.

17. Statement from the Contractor indicating whether they are under Part I (signatory to Hometown Plan) or Part II (abiding by the affirmative actions and goals of minority manpower utilization) of the Hometown Plan Bid-Conditions (Applicable under Hometown Plan Provisions only).

18. For all applicable crafts, copies of "Optional Form 66" (Manpower Utilization Report) for all applicable Contractors and, if all minority utilization goals are not being met, a copy of the explanation as to why the Contractor is not meeting the goals. (Applicable under Hometown Plan Provisions only).

19. Federal-Aid Highway Construction Contractors Annual EEO Report Form PR-1391 (Required on all Federal-Aid contracts).

It is the responsibility of each prime contractor to ensure subcontractor compliance with all the previous mentioned minimum documentation requirements for Equal Employment Opportunity.

Affirmative action by DO personnel in the specified contract requirements is essential in order to accomplish the goals of Equal Employment Opportunity.

The outlined EEO documentation requirements will meet current FHWA Equal Employment Opportunity Provision Requirements for Federal-Aid Highway contracts.

2.17 CONTRACT REQUIRED INSURANCE

Insurance for a contract is specified within the SS. The purpose for requiring insurance is to underwrite the Contractor's work in case there are performance or default issues that arise during the contract. The Contractor's required insurance will help the Department continue the contract, complete the contract, or recover contract loss. Information on the requirements of contract insurance is located within 103.05 of the SS.

Prior to commencing the work, the Contractor must furnish evidence of insurance as required by the CIB and 103.05 of the SS. The Division of Contract Administration will administer the insurance filings and maintain the files. Contract Administration will distribute periodic notifications on the status of contract insurance to help the DO in monitoring insurance expirations for contracts. The PEMS will enforce 103.05 of the SS. When the Contractor fails to submit the insurance documents in a reasonable time after the award of the contract, a Notice to Proceed may be issued accompanied with a letter advising the DO that no physical work at the job site is to be permitted until the Contractor furnishes the required insurance documents. In this instance contract time shall be assessed, in accordance with the provisions of the contract, the same as would normally be assessed if the Contractor could proceed. The DO will be advised by CO when the insurance documents have been filed and work may begin.

Approximately every 10-14 days, the DO will receive a computer listing of active contracts within their DO. The first part of the listing will show those contracts on which insurance will expire within a few weeks. The second part of the listing will show all active contracts, for information only.

The DO shall review the listing of contracts on which insurance expiration is near and determine whether renewal is necessary. For example, if the contract has been completed, or will be completed, prior to the expiration date, usually renewal is not necessary. NOTE: specific contracts remain on the listing until the Final Acceptance Letter is issued.

If the DO determines that renewal of insurance is necessary, the DO shall send a letter of notification to the PEMS. The letter shall specifically state that the insurance documents must be sent directly to the Contract Estimating Administrator in the Division of Contract Administration, and that if evidence of renewal is not received prior to the expiration date, work on the contract shall be suspended in accordance with 103.05 of the SS. This section of the SS requires that no work shall be performed by the Contractor without insurance except that necessary for traffic maintenance and the protection of life and property. It is the DO’s responsibility to see that this specification is strictly enforced.

When Railroad Protective Liability insurance expires, no work shall be performed by the Contractor on, over, or under the railroad’s property, or within 50 feet of the railroad’s tracks until this insurance is renewed. Work may continue on the contract in other areas provided all other insurance is in force.

As soon as the PEMS is made aware of the pending expiration, he or she should inform the Contractor’s contract manager that all work will be suspended after the expiration date until notification of renewal is received. Contract time shall continue to be assessed in accordance with the contract. Suspension of work, notification of renewal, and resumption of work shall be noted on the Daily Reports.

The DO may verify the status of any contract insurance. The files will be updated daily and may be reviewed by the DO. It is the DO’s responsibility to help monitor contract insurance and inform the PEMS when the insurance filing or renewal has been made. No other notification will be sent to the DO of filings and renewals. The DO shall notify the PEMS as soon as possible. Any follow up notification should state the date on which the original notification was made.

If the Contractor asserts that the insurance filing or renewal has been made, but the DO is unable to verify this fact, the DO may consult with the Contract Management Supervisor in the Division of Contract Administration for verification and assistance.

2.18 CONTRACT TIME ADJUSTMENTS AND TIME WAIVERS

The primary difference between a contract time adjustment and a time waiver is that a contract time adjustment is associated with changes in the physical work performed on the contract and a time waiver is not. Physical work is work performed by the Contractor, a subcontractor, or a third party such as a utility or railroad. A contract time adjustment is typically used when necessary to revise the contract time up until the All Contract Work Complete date. A time waiver is typically used to eliminate liquidated damages for delays that are not the fault of the Contractor after the All Contract Work Complete date.

The following guidance should be used for all contract time adjustments and time waivers. This guidance is in addition to the requirements of the Department's policy for time extensions and is not intended to supersede any part of the policy. The Department's change order and time extension policy is included as an attachment to Construction Memo 22-08.

2.18.1 Contract Time Adjustments

A contract time adjustment is used when it is necessary, as defined in the contract documents, to modify a contract's original completion date for specified contract work. Contract time adjustments also apply to all types of intermediate contract dates, such as intermediate completion dates, closure periods, mowing cycles, and any other date or time specified in the contract, either original or by change order. Intermediate contract dates are referenced as Informational Contract Times within AWP.

For an intermediate completion date, completion of the work means that the portion of work specified in the contract for that date or period has been completed, opened to traffic, and can be placed into service for its intended purpose.

An intermediate contract date is to be documented within the Informational Contract Times within AWP. The following Contract Time information is recorded:

- Description of intermediate contract date
- Type of time charged
- Rate of time charged
- Bid time (if applicable)
- Time charged (if applicable)
- Time remaining (if applicable)
- Incentive/Disincentive rate amount (if applicable)
- Intermediate contract start date
- Original intermediate contract completion date
- Adjusted intermediate contract completion date
- Actual intermediate contract completion date.

The initial Contract Time information is usually uploaded at the beginning of the contract. If not, the PEMS will need to create a new Contract Time entry for the intermediate contract date and follow the prompts accordingly. To verify if intermediate contract dates are applicable to the contract, refer to the CIB. All contract times are to be monitored and completed as the event occurs. Do not wait until the end of the contract to enter milestone dates. Consult the AWP training manuals located in the AWP Home page.

For a contract completion date or time, completion is defined as the last day of work. However, when the contract reaches the stage of All Contract Work Complete and the Contractor and the Department agree that the project is ready for pre-final inspection, additional time is given, in accordance with 108.09, for punchlist work and removal of signs, which generally constitutes the last day of work. Additional time granted for punchlist work and removal of signs should be addressed by a time waiver and <u>not</u> a contract time adjustment.

The Contractor must request all time extensions. The request must include documentation on the requested time extension and its impact on the scheduled critical path of the contract. A contract time adjustment must be documented on an approved change order. The change order should be generated as soon as the adjustment is agreed upon by the Contractor and the Department. Full justification and adequate documentation of the time extension must be included in the change order. A calculation supporting the number of days granted or a relationship to the schedule for a date granted should be provided as an attachment.

When a change order is generated to add new work or significantly change the quantities of existing work, the time associated with the work should be addressed in the same change order. In cases where the time associated with the change cannot be determined, an exception may be made to address the time on a future change order.

One of the following statements must be included in the explanation portion of each change order:

- **TA** - A contract time adjustment is required for this change and has been addressed herein.
- **TAP** - A contract time adjustment is potentially required for this change, but cannot be quantified at this date. Any contract time adjustment required for this change will be addressed by change order at a future date.
- **TAN** - A contract time adjustment is not required for this change.

When a contract time adjustment is not made at the same time as the change order revising the work, the future change order that addresses the time <u>must include a reference in the explanation to the original change order that revised the associated work</u>.

2.18.2 Time Waivers

Time Waivers are used to excuse liquidated damages between the All Contract Work Complete date and Final Acceptance date. Time waivers should be used in the following two instances.

The first instance occurs when time waivers are granted between the All Contract Work Complete date and the Last Day of Work date. To justify days intended to be waived, the PEMS must document the types of operations that took place during this time period within the diary entry on the Last Day of Work. The documentation should indicate how much of this time period is due to waiting on sod maintenance to expire or due to obtaining the NOT. Because extra work that is added at the pre-final inspection falls within the All Contract Work Complete date and the Last Day of Work date, a change order to adjust contract time is not necessary. Additional time to complete extra work should be agreed to at the pre-final inspection and documented in the diary on the Last Day of Work. This work should not be included with the 5 days allotted to perform corrective or cleanup work for the final inspection in accordance with 108.09 of the SS.

Unlike the first instance where the appropriate time waiver is automatically captured in the IC-632, in the second instance, which falls later in the contract timeline between the Last Day of Work date and the Final Acceptance date, a Time Waiver Change Order is required. This change order will be of the Type "Time Waiver". The amount of days granted by the time waiver will be entered on the Time Adjustment Tab. This time waiver Change Order will not affect any milestone or the Adjusted Contract Completion Date but will excuse the desired number of liquidated damage days that would have been assessed between the Last Day of Work date and the Final Acceptance date.

One example of when to use a “Time Waiver” Change Order is as follows:

The Department conducted an HMA mix design review for HMA placed on a contract.

- The Contractor had completed their work and punchlist on 9/30/23 and INDOT issued the Release of Signing Responsibility, IC-686, after the final inspection.
- The Contractor removed their signs on 10/01/23 and this day was entered into AWP as the Last Day of Work date.
- INDOT was currently reviewing the HMA mix designs for binder content on this contract which were found to be in error due to a Department miscalculation on the acceptance sample and beyond the Contractor’s control or responsibility.
- The HMA mix design binder content review was completed with no issues found on 4/15/24. INDOT issued the final acceptance letter and this date was entered into AWP as the Final Acceptance date.

If the Contractor was found to have had no responsibility with the mix design binder content as determined from the HMA review, the Contractor would be excused of the liquidated damages between their Last Day of Work date and the Final Acceptance date. Therefore, a time waiver would be created between 4/15/24 (Final Acceptance date) and 10/01/23 (Last Day of Work date). The difference in these two dates would be 196 days and should be entered in AWP on the corresponding “Time Waiver” change order.

A "Time Waiver" change order would not be used for operations such as NOT or sod maintenance. NOT and sod maintenance must undergo final inspection before the contract can be accepted. On the day NOT or sod maintenance is obtained on a contract where the signs have already been removed, the Release of Signing Responsibility, IC-686, will be issued and will be marked as the Last Day of Work. The Completion Date and Liquidated Damages Data form, IC-632, will already capture this waiver period allowed for pre-final inspection, punchlist, final inspection, and signs removal, in accordance with 108.09 of the SS.

Questions concerning the use and documentation of contract time adjustments and time waivers should be addressed to the appropriate Construction Management Field Engineer.

2.18.3 Above Normal Inclement Weather Contract Time Adjustments

Above normal inclement weather, as defined in the SS, is a commonly utilized reason for a Contract Time Adjustment. The number of approved days should be calculated in accordance with the SS requirements.

It is critical for both the PEMS and the Contractor to engage in open and transparent communications as to whether a day is considered workable on the controlling operation or critical path. It may be necessary for the Contractor to describe and clarify alternate plans for upcoming work. Those plans should include how the weather event affects the controlling operation and critical path. The following must be considered when calculating a time adjustment due to above normal inclement weather days:

- Workable days are calculated on a yearly basis for each construction season from April 1st through November 31st. **Inclement weather days are not calculated on a month-by-month basis.**

- Workable days are calculated if the controlling operation on a Contractor's accepted schedule was delayed due to inclement weather.

- Workable days are calculated by considering the date of the weather event itself and any additional days which continue to be un-workable on the controlling operation due to the event.

- Workable days are calculated by prorating the months during which the construction contract begins and ends. The number of calculated days should be rounded according to the Department's rules for rounding found in General Note No. 9, located in the front pages of the SS. (*See* **Example #1**)

- Workable days are calculated for bundled contracts based on how each project has been independently affected by the event. In accordance with the SS, time extension requests for specific projects should be reviewed and considered based on the critical path for the overall contract.

- Workable days are calculated on closure periods and time periods involving intermediate completion dates independently by utilizing only the period of time involved and prorating as appropriate. (*See* **Example #2**)

- Workable days are calculated even when the Contractor requests inclement weather days that occurred on a contract that, after receiving the Notice to Proceed, was started late, was within the Contractor' s control, and was not the fault of the Department. (*See* **Example #3**)

- Workable days are calculated on non-working weekend days or holiday periods when the Contractor is not required to shut down operations. (*See* **Example #4**)

A weekly report showing the controlling operation and workable days is required to be furnished to the Contractor on a weekly basis. The Contractor will be allowed one week from the date of receipt of the report in which to file a written protest stating their disagreement with the report. If no written disagreement is received within the allowable time frame, the weekly report will be deemed as being accepted by the Contractor. It is essential that concurrence is made in a timely manner between the PEMS and the Contractor to alleviate time extension disagreements and construction claims.

Example #1 - Prorated Time:
If the contract completion date for an "R" contract is November 17th, then the number of days to be used for an estimate of inclement weather for the 17 days in November would be calculated as:

$$\text{Prorated time} = \frac{17 \text{ days}}{30 \text{ days (November)}} \times 12 \text{ days (from table in 101.02 of the SS)}$$

$$= 6.8 \text{ days } (\textbf{rounds to 7 days}).$$

Example #2 - Intermediate Completion Dates:
If an "R" contract is scheduled to start on April 1st with an intermediate completion date of July 31st, the inclement weather time frame will only involve the time period between and including these two end dates. Therefore, using the table in 101.02, if more than the 36 inclement weather days (18 days for April + 8 days for May + 5 days for June + 5 days for July) occur during this period, a time extension should be generated for the extra days and added to the July 31st date.

Example #3 - Delayed Start:
When the Contractor should have started active work on April 1st but did not start until August 1st and the contract completion date is October 1st, the Contractor would like the Department to not consider the time from April 1st to August 1st in the inclement weather calculations. Based on the SS which state that the Contractor is expected to start active and continuous work in a timely manner after issuance of the Notice to Proceed, the entire time frame that the Contractor could

have worked will be considered (April 1st to October 1st) in the inclement weather calculations.

Example #4 - Non-working Weekends and Holidays:
If the Contractor has not been working weekends and inclement weather days take place on a Saturday or Sunday, the inclement weather days that take place on Saturdays and Sundays will still be counted in the inclement weather day calculation. Similarly, for a holiday where the Contractor is not required to shut down work operations but has not been working on the holidays, the inclement weather days that take place during the holidays will still be counted in the calculation.

2.18.4 Inclement Weather During Approved Contract Time Adjustments

Inclement weather days that occur within an approved time adjustment will be considered on a day-for-day basis. The Department will grant an excusable, non-compensable delay for every day that work on the controlling operation cannot take place during an approved time adjustment period due to inclement weather. (*See* **Example** below.)

Example:
If the Contractor is granted a 10-day time extension, then 10 days of workable weather should be granted to allow the work planned for the inclement weather days to be accomplished. The granted days would include Saturdays and Sundays. Once the end of the granted 10-day workable time extension ends, the Contractor will be charged liquidated damages based on the contract documents. The Department expects the Contractor to bid in the potential risk of inclement weather within the original time frame of the contract but does not expect the Contractor to bid in risk during potential time extensions to the contract.

2.19 CHANGE ORDERS

A Change Order is a written agreement executed by the Department and the Contractor that modifies an existing contract.

In order for the Department to track and manage Change Orders, each Change Order must accurately identify the reason for the contract modification.

2.19.1 Contract Modifications

A Change Order must be executed to document any of the following changes to a contract:

- Monetary Adjustment
- Time Adjustment
- Scope or Design Change.

Monetary adjustments may result in additional compensation for the Contractor or a credit to the Department. They may result from changes in quantities associated with existing contract pay items or the addition of new pay items to the contract.

Time adjustments may result in either increased or reduced contract time to perform work associated with closure periods, intermediate completion dates, or the contract completion date. Once the time adjustment change order for an intermediate contract date is approved in AWP, the time adjustment will be conveyed to the appropriate contract time.

One form of scope and design change is a Construction Change. Construction changes occur when issues are found after the letting which require a change in the scope or design. Construction changes typically include revised plan sheets or specifications related to a revised design or a changed condition. Construction changes for contracts can be found on INDOT's website. They are posted for viewing or download. These scope or design changes may result in monetary adjustments, or time adjustments, or both.

2.19.2 Procedure for Documenting Non-Participation Pay Items

Non-participating means that a pay item is not eligible for federal funding and "participating" means that an item is eligible for federal funding. Federal regulations prohibit the use of federal funds for payment of some pay items.

Prior to executing change orders that add new pay items to the contract, the PEMS should check the list of non-participating work categories provided below. Verify whether any of the pay items included in the change order require a non-participating designation. In situations where the non-participating category is required, designate the affected pay items as non-participating. Purchase orders utilizing 100% State or 100% LPA funds must be utilized to pay for these non-participating items.

An item should only be identified as non-participating within a change order if it is an item being added to the contract that FHWA would not normally agree to participate in the funding. To indicate a pay item as non-participating within a change order, make sure the item is identified as such within the change order.

Below is a list of frequent federal non-participating categories:

- Payment for work outside the highway ROW without permits, etc.

- Payment for work outside the limits of the project (unless necessary to implement project, traffic control, etc.) Work performed outside the NEPA limits of the project may jeopardize federal funding for the project without FHWA prior approval.

- Payment for work not required by the project plans. (Example: fence upgrades, utility upgrades, etc.).

- Payment for modifications of privately owned facilities. (Example: signs, fences, lawn sprinklers, etc., unless covered as a part of a ROW agreement or permit).

- Payment for storm and sanitary sewer work and other drainage or utility work that is not a result or purpose of the road or bridge work. (Example: replacing sewer leads that were not in conflict with the construction activity proposed). Payment for costs incurred solely for the benefit of a railroad or utility, or for betterments that are not currently part of the project. (Example: payment for excess sizing of sanitary sewer adjustment for future development. The additional cost over replacement-in-kind should be borne by the owner of the facility being adjusted).

- Payment for excessively expensive treatment work that does not appear to be in the public interest. This could include accelerating the project for other than mitigating an excusable delay, or proposing the use of very extravagant roadway treatments or street side appurtenances.

- Payment for significant hauling or transportation charges of salvaged items to Department or agency garages or storage sites for future use on non-federal projects. Although, hauling material for less than 5 miles from the project site has been considered a reasonable distance and would be eligible for payment.

- Payment for non-conforming work such as substandard details, designs determined undesirable or discontinued because of poor performance. (Example: A588 guardrail, salt susceptible roadside plantings, etc.)

- Payment for work that is the responsibility of others, such as relocation of utilities located within the ROW, and relocation of public facilities outside their corporate limits.

- Payment for accident damage when a work zone MOT is not in place due to the increased risk of accidents or when financial recovery has been obtained from the responsible party, such as driver, owner, or insurance company. If financial recovery has been transferred to the Department’s Damage to State Property process, then the accident damage is not eligible for participation.

- Payment for work done by an unapproved subcontractor.

- Payment for work that should typically be considered maintenance work by the Department or Local agency. (Examples: graffiti removal, snow plowing, trash removal, moving roadsides, etc.)

- Payment for rework (including incorporated materials, etc.).

- Payment of work and materials not meeting specifications that are incorporated into the project.

- Payment for change order work performed using the force account method that is not in accordance with the SS.

- Payment for work included on a change order or a contract revision that was required to have prior approval by FHWA for FHWA oversight contracts but did not obtain prior approval.

- Payment for the incorporation of iron or steel products that are subject to Build America Buy America (BABA) but have not been certified as compliant with BABA requirements. **Note:** Any product that should have a BABA certification but is deemed as non-participating is not allowed as it circumvents the BABA compliance requirements and jeopardizes the Federal aid eligibility of the entire project.

- Payment for costs that arise from negligence, intentional acts or omissions, fraud, carelessness, incompetence or other actions by the Department which are not consistent with the usual Department practices.

- Payment for contract claim settlements if the Department is determined to be negligent. (Example: utility and ROW claims)

The PEMS must work with DO personnel to either add the required funds to an existing 100% State funded or 100% LPA funded purchase order, as appropriate, or to establish new 100% State funded, or 100% LPA funded purchase orders to facilitate payment for the non-participating work.

An item on a change order indicated as non-participating does not mean that the entire change order itself will be non-participating. If there are both participating and non-participating items on the same change order, ensure that the appropriate dollar amounts are indicated when adding the funds to purchase orders.

Once the non-participating item is added to the contract an “*” will be included with the item on the estimate. Please note that it is not necessary to designate the item as non-participating in the new item name, but it should be explained that the item is non-participating when the change order explanation is prepared in AWP.

2.19.3 Procedure for Documenting Non-Participation in Time Extensions

When FHWA determines they will not participate in state-approved time extensions, the non-participation time period and associated costs will be documented by separating the cost of the field office pay item and the Department’s contract field staff payroll records for construction inspection into participating and non-participating components. During the timeframe for a standard contract from the beginning of construction until the FCR is complete, the contract is kept open and the field office and administrative costs of the inspection staff are compensated.

This procedure will extract only the portion of the non-participating time out of the standard process.

For example:
A contract is to be completed on November 15. Time extensions totaling 45 days are granted to the Contractor for reasons that the Department has determined are outside of the Contractor's control. Fifteen of the 45 days are granted from November 16 to November 30 and the remaining 30 days extend into the following construction season from April 1 to April 30. Therefore, the contract completion date is extended to April 30. FHWA agrees to participate in only 30 days of the Department approved, 45-day extension. In this case, 15 days of the Department approved time extension must be paid through a non-participating item and Department contract field staff time charged to a State funded labor code.

Suggestion:

1. **Place non-participating time at the end of the state-approved time extension period.** For the time period from April 16 - April 30 (the final 15 days of the time extension) the field office will be paid for by a non-participating field office item and the Department's contract field staff will charge time to a State funded labor code so no federal reimbursement will be sought. Beginning May 1, the field office payment will return to the original participating item and the Department's contract field staff will return to charging time to the federal project number. The non-participating time is clearly separated in this option. The pay items are on record and a note can be included in the project files and FCR showing the times charged to a separate labor code.

2. **Place non-participating time at the end of the contract.** If there are 15 non-participation days, continue to charge for the field office using the participating item until the last month the field office is used, and then create a new non-participating item. Likewise, continue charging time to the federal project number and switch to the State labor code during the last month. This scenario could be more difficult to determine exactly when to switch the pay item and labor codes. This time period will occur after construction has been completed and during the time when the staff is working on the final construction record. This could be particularly difficult if the non-participating time period is large.

Essentially, the Department will not charge FHWA for the construction inspection costs for the non-participating timeframe. This will be accomplished by adding the field office as a non-participating item, by change order, during the time of the non-participating delay. The non-participating costs will be the construction inspection costs alone and will not include, or be based upon, the value of the Liquidated Damages amount waived.

This process will not be utilized when the time extension is for an intermediate completion date, as the inspection costs would still be incurred beyond that time regardless. All time extensions, including intermediate time extensions, must contain sufficient documentation to obtain FHWA participation. This inclusion will help to eliminate the risk of the Department having to credit back the liquidated damages rate for the number of days of the time extension. Furthermore, if the Contractor substantially completes the work prior to the adjusted non-participating time extension date, the Department would stop using the State labor code and the non-participating field office item at that date and go back to charging Department field staff time to the project, using the participating field office item until the completion of the final.

2.19.4 Extent of Work Covered by Change Order

In order to help manage Change Order information, it is necessary to limit pay items included in a Change Order to only those items required to mitigate a specific event or for a specific reason code. It is possible for a Change Order to include monetary adjustments, time adjustments, and scope or design changes as long as each Change Order component is related to the mitigation of the same event.

For example: An existing utility is found to be in conflict with a planned storm sewer trunk line. It is determined that the appropriate mitigation for the conflict is to split the trunk line into two smaller pipes that are installed around the utility. It is acceptable for all of the following to be included in the same Change Order:

- Monetary adjustments resulting from quantity changes for existing pay items and the addition of new pay items required to construct the revised storm sewer structures around the existing utility.
- Time adjustments to increase or decrease planned closure periods, intermediate completion dates, and the contract completion date as required for construction of the revised storm sewer facilities.
- Scope or design changes consisting of revised plans and new specifications required to construct the revised storm sewer.

It would <u>not be acceptable</u> to include a monetary adjustment associated with changing the pavement marking material throughout the contract area from paint to thermoplastic on the above noted Change Order. The type of pavement marking materials is not affected by the revised storm sewer layout. A separate Change Order would be required to document the change in pavement marking material.

2.19.5 Reason Codes

Reason codes are used to categorize Change Orders so that the Department can track the cause of changes, assess the extent and source of accountability, and work to minimize similar changes on future contracts.

Each Change Order requires selection of a reason code from the drop-down menu within the AWP Change Order module. Only one reason code may be selected per Change Order. The AE and FE assigned to the District are available for guidance regarding selection of the proper reason code for individual Change Orders.

Below is a list of the available reason codes and their sub-categories:

REASON CODE	SUB-CATEGORY
Errors and Omissions	Design/Plan Related Specification Related Special Provision Related Environmental Related Item Related Permits Related Quantity Related, Minor Quantity Related, Major R/W Related Geotechnical Related Traffic Control Related Utility Related Railroad Related Constructability Related
Scope Changes	Work Outside Construction Limits Work on Private Facilities Project Acceleration Project Upgrades Material Related Added Quantities/Items Deleted Quantities/Items
Changed Conditions	Constructability Related Permits Related Environmental Related Materials Related R/W Related Geotechnical Related Utility Related Railroad Related Weather Related Quantity Related

Payment Adjustments	Quality Related Material Related Contract Liens Related
Incentive/Disincentive	Contract Completion Intermediate Completion Closure Times Cost Reduction Incentive A+B Contract A+B+C Contract
Standards/Specifications Change	Time Related Monetary Related Time and Monetary Related Specification Change Only
Final Quantity Adjustment	
Damage to State Property	
Contract Renewal	
Maint. Of Traffic Safety Improvements	
Emergency Work	

- **Errors and Omissions** - Change Orders are often required because contract documents include incorrect information, or the documents omit an element required to construct the overall contract in accordance with its original scope. The Contractor is entitled to consideration of monetary and time adjustments in situations involving errors and omissions. The PM needs to be informed when errors or omissions are found in a contract so they can help with the resolution of the issue and involve the Designer early in the change order process. In this way, the Designer may be held accountable for extra costs or damages that are involved on the project, if the errors or omissions arise from the Designer's negligence. The key to using the Errors and Omissions reason code is that the situations giving rise to the reason for the extra costs, arising from the Designer's negligent errors or omissions, should have been caught prior to contract letting. If the problems could not have been known ahead of time, through reasonable due diligence, then the reason codes selected for the Change Order will, most likely, be from the Changed Conditions section.

  <u>Design/Plan Related</u>: This reason code is used when there is a problem with the design/plans on the project. Examples of this may be that the wrong size drain pipe was called for on the project and it has to be changed to a new size pipe which could require new items for pipes and potentially inlets and manholes.

Specification Related: This reason code is used when the contract specifications did not adequately cover a need on the project. An example of this would be where there is an item in the itemized proposal and there is not an item in the specifications that matches or describes this item.

Special Provision Related: This reason code is used when the special provision of the contract does not adequately cover the work in the contract for which it is meant to cover. An example of this could be that a special provision specifies that the only products that you can use to build the work are found to not meet the requirements of Buy America and because of this extra costs were incurred and/or not participated in by FHWA.

Environmental Related: This reason code is used when an issue involves things that are environmental in nature that were overlooked in the contract documents. For example, an underground storage tank is found on newly purchased property and the designer should have been able to tell that it was there utilizing reasonable due diligence but did not show it in the contract documents or give a way to handle its removal. Evidence of this could be that there are visible signs at ground level that the tank exists beneath the surface. In this case, one might also consider the Design/Plan Related reason code because it was left off the plans. Such a situation should be viewed in a manner that the reason code that best represents the situation should be used. In this case, it is an omission from the plans, but because it is environmental in nature, this reason code is more exact in description and should be used. As additional information, this situation would merit a reason code of Changed Condition Environmental Related if a tank was found, but there was no means to tell that it existed other than discovering it during excavation. Another example would be if there was a storm water management plan shown on the plans but no items were placed in the itemized proposal to cover the work.

Item Related: This reason code should be used for items that are missing from the contract and the design would dictate that they be in the Itemized Proposal. For example, this reason code could be used if an HMA overlay was being placed that required that the existing surface be milled first and there was no item in the contract to cover the work.

Permits Related: This reason code should be used when extra costs are incurred because a permit was not obtained for the contract either by the Design Consultant or by INDOT.

Quantity Related, Minor: This reason code should be used when there is a quantity increase or decrease that is caused by a mistake made by the designer of the contract and the result was less than 5% of the original contract award amount or $250,000.00 whichever is less. An example of this would be where the item for HMA surface overran on a project because the designer did not add in the quantities for the S-lines on the project.

Quantity Related, Major: This reason code should be used when there is a quantity increase or decrease that is caused by a mistake made by the designer of the contract and the result was more than 5% of the original award amount or $250,000.00 whichever is less. An example for this could be the same as above in minor.

Right-of-Way Related: This reason code should be used when extra costs are incurred because of ROW problems. An example of this could be when there was only enough ROW purchased for the building of the face panels for an MSE retaining wall but the amount of ROW did not allow for the placement of the straps behind the wall.

Geotechnical Related: This reason code should be used when extra costs are incurred which are related to soils information on the project. An example of this is when the geotechnical report for the project says that the project will need to be undercut by 2 feet and the material replaced with aggregate No. 53 and the designer had this information during design but did not take this into account in the plans and then the costs for the undercut and aggregate had to be added by change order.

Traffic Control Related: This reason code should be used when extra costs are incurred related to problems with traffic control on the project. An example of this could be when a contract requires lane shifts and lane closures and no items were included in the contract to cover temporary pavement markings.

Utility Related: This reason code should be used when extra costs are incurred related to problems with utilities that should have been foreseen by the designer using reasonable due diligence in preparing the plans. An example of this would be where there is a conflict between an existing water line and a new sewer line to be installed where the water valve present in the area can be seen and there was no prior coordination done with the water line owner to move the line. If the water line existed in the area and could not be seen and is only found after installation of the water line has started, the reason code for a changed condition should be used.

Railroad Related: This reason code should be used when extra costs are incurred related to problems with railroad concerns that should have been able to be foreseen by the designer. An example of this would be if the plans show constructing a temporary railroad bridge and shifting train traffic to the new bridge that will require that there can be no train traffic for 2 weeks while the tie-ins are completed, but the railroad determines that they cannot allow a 2-week shutdown of train traffic at that time. This situation should have been coordinated prior to letting and should have been resolved. This will now cause a delay for the contractor and extra costs to be incurred. In addition, note that these extra costs and the corresponding time extension may potentially be non-participating by FHWA.

Constructability Related: This reason code should be used when the plans did not take into account an obvious physical condition that exists on a project and then the condition requires extra costs to be incurred to remedy the situation. An example of this would be where the plans call for common excavation be used to build the required embankments for phase 1 of a project but the common excavation exists under the roadway which will be used to maintain traffic during phase 1 and because of this it is a requirement to pay to bring in borrow on the project and then to remove and waste the common after phase 1 is complete.

- **Scope Changes -** Scope changes include situations where the Department determines that it is necessary to either add items to the contract that are unrelated to the current scope, delete items related to a portion of the current scope, or increase or decrease the area over which the current contract scope will be constructed. Scope changes are the responsibility of the Department and consideration of monetary and time adjustments is warranted. Scope changes may not be implemented without the approval of the PM. Approval from the PM must be included in the allotted section of the Change Order Form. As noted above, such scope changes are generally non-participating unless a Cost Effectiveness Finding has been approved. Scanned e-mail or other documentation from the PM is also acceptable once included as an attachment for the Change order.

Work Outside Construction Limits: This reason code should be used when work is performed outside of the construction limits of the contract. Outside of the construction limits should be taken to mean off the ROW or beyond the station limits of the work area in the contract. Note that traffic control items that are needed for pre-warning are not a part of the discussion under this reason code. This is important because when work beyond the construction limits of the contract is undertaken, this work is outside of what has been approved in the NEPA documents. An example of this would be if concrete patching is required to be added to the contract that is a mile from the end of the contract. Another example would be where the HMA overlay on the project was to be stopped before entering an intersection and it was decided to continue the HMA through the intersection because the pavement was rough. In both of these cases this work should not take place unless approved by the Project Manager.

Work On Private Facilities: This reason code should be used when work is performed for items that are not owned by INDOT or the LPA and are not a part of the original contract. An example of this might be where a utility line running through the project is in the way of the work that is needed to be performed but it is decided not to wait for the utility to move the facility, so a determination is made to move it for them (with their permission).

Project Acceleration: This reason code should be used when a determination has been made to make up lost time on a project, which could be caused by issues that delayed the project. One example of this would be if a very rainy construction season occurred and a time extension is warranted that would move the completion of the project into the spring but commitments have been made to have the work completed before the end of the year.

Project Upgrades: This item code should be used when a determination has been made to add an element to a project or enhance an existing element on a project. An example of this would be to add a conduit to the project in order to place communication cable through it at a later date. Another situation would be if lighting items already exist in the contract but a determination was made to make the light poles decorative in design. It is important for the PM to be involved in project upgrades to ensure that the costs for the upgrades are accepted by the responsible entity.

Material Related: This item code should be used when a determination has been made to change a type of material that is being used to construct the contract. An example would be if the road was designed to use an HMA pavement and a determination was made to change the road to PCCP.

<u>Added Quantities</u>: This item code should be used when a determination has been made to add additional quantities of an item that would utilize the item in a way or in an area in which it was not approved for use in the original scope of the project. An example of this would be if the original scope of the project included sidewalk on only one side of road and it was then decided after the letting to add sidewalk to the other side of the road as well. This may make sense from a cost standpoint since the Contactor is already in the area and it would not be a challenge to add the additional quantity. However, it should be noted that because the scope of the original project included sidewalk on only one side of the road, adding this would be a scope change and may not get approval from FHWA for participation.

<u>Deleted Quantities</u>: This item code should be used when a determination has been made to delete quantities of an item and thus construct a project that does not fulfill the original scope of the contract. An example of this could be when the original project scope included sidewalk on both sides of the road and because of other overruns on the contract it was decided to delete the sidewalk from one side because there is not enough money left to complete the work. However, it should be noted that if the sidewalk is not built on both sides as originally approved, FHWA could consider not funding the entire project since the original scope is not being fulfilled.

- **Changed Conditions -** Changed conditions are defined in Section 104.02 of the SS. They include differing site conditions, suspension of work by the Department, and significant changes in the character of the work.

  Differing site conditions and what constitutes them are described within 104.02(a) of the SS and include two basic conditions:

  1. subsurface or latent physical conditions encountered at the site differing materially from those indicated in the contract or

  2. unknown physical conditions encountered at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract.

  They are the most common type of changed conditions encountered in the field. In most situations, it is the Contractor that discovers a potential differing site condition. The Contractor is required to provide notice prior to performing any work at the affected location. It is the Department's responsibility to verify whether the situation represents a differing site condition and to determine the required work, if any, to mitigate the problem. Examples of differing site conditions include the presence of an underground storage tank that is not indicated on the plans, discovery of a peat deposit at a location where peat is not anticipated, and discovery of an existing concrete base under the asphalt pavement on a contract that includes no pay item for pavement removal.

Suspensions of work, included in 104.02 of the SS, are related to suspensions directed by the Department for the benefit of the Department or the traveling public. Examples of these suspensions include suspensions of work for holidays or community festivals not noted in the contract documents. Suspensions of work related to poor workmanship, contract breaches by the Contractor, or operational problems of the Contractor are not covered by changed conditions.

The most common occurrence of significant changes in the character of the work is related to a major pay item that has a quantity increase, or decrease, by more than 25% from the original planned quantity. Typically, increases in quantities justify a lower unit price and reductions in quantities justify a higher unit price. Consideration for monetary and time adjustments is usually required when changed conditions are encountered on a contract.

Constructability Related: This reason code should be used when there is an issue that changes how the project is to be constructed. An example of this would be where the contractor bid to build a bridge with the road closed to traffic and it was determined after letting that the contractor would need to build the bridge under traffic.

Permits Related: This reason code should be used when the cause of the changed condition and extra costs are permit related. An example would be if the contract stated that the permit would be obtained so that the contractor could start work on August 1st but it was not obtained until December 1st. This could potentially cause a project delay and extra costs if the work is a controlling item.

Environmental Related: This reason code should be used when the reason is environmental in nature. Examples would be finding an underground storage tank, historic artifact, asbestos, contaminated soil or an endangered species, any of which were not known to exist at the time of letting.

Material Related: An example would be encountering a different material than anticipated in the plan documents such as rock at an elevation where soil was expected. This would require a change to incorporate rock excavation.

Right-of-Way Related: This reason code should be used when the issue is related to the availability of ROW on the project. An example of this is when the ROW is supposed to be already cleared so that the contractor can access it to work and it is found that it is not cleared and causes a delay or extra cost. It should be noted that delays in availability of ROW are not reimbursable by the FHWA.

Geotechnical Related: This reason code should be used when there is an unforeseen geotechnical issue found on the project. An example would be where the soils report and borings do not show peat in an area but it is in found where the end of a tie back is to go and will no longer work and causes delay or extra costs.

Utility Related: This reason code should be used when there is a changed condition caused by a utility related issue. For example the contract book states that a utility will be relocated 30 days after the ROW is staked and cleared but it takes the utility 100 days which causes extra cost and/or extra time to be needed on the contract.

Railroad Related: This reason code is used when extra costs are incurred related to railroad work on a contract where it is a changed condition to the contract but that could not have been foreseen beforehand by the designer under normal due diligence. An example of this would be where the contractor tried to get railroad flagmen as required by the contract but the railroad for whatever reason would not supply them which causes a delay to the contract and thus extra costs.

Weather Related: This reason code should be used when the above normal inclement weather days for the year exceed the yearly allotted number of days in the Standard Specifications. This would normally be needed for time extension purposes only as weather is normally non-compensable. However, there could be times where the contract may be written that would allow compensation.

Quantity Related: This reason code should be used when there is a large change in the quantity of either a major or minor item due to unforeseen circumstances that, by specifications, would allow a change in the unit price for the item. An example of this would be that during a resurface contract it is required to remove the overlay and perform pavement patching and when the overlay is removed, the pavement is in worse shape than the pavement cores led the designers to believe and additional patching work is required.

- **Payment Adjustments** - Payment Adjustments reason codes are used when there are credits to the contract or extra payments to the Contractor. This would include overruns to the 1 DOLLAR unit cost items usually found in the beginning of the itemized proposal, with the exception of Liquidated Damages which is a part of Incentive/Disincentive and are self-explanatory. Additionally, Payment Adjustment reason codes should be used for Quality Adjustments for HMA, Storm Water Management, Temporary Traffic Control, Failed Materials, Binder Adjustments, Liens, etc. Payment Adjustments reason codes will fall into one of the following sub-codes:

Quality Related: Examples include HMA Adjustments, Storm Water Management Adjustments, Temporary Traffic Control Adjustments, Failed Materials, For example if there are adjustments that need to be made to the payment to the contractor after the pay factors are reviewed in accordance with 401.19 for HMA then this reason code will be used. This would be the same for concrete pavements in accordance with 501.28. Other examples of when this reason code will be used are when either storm water management devices or traffic control devices do not meet the quality standards within the specifications. The cost associated with this work can be tracked and therefore not counted against the "On Budget" metrics.

Material Related: An example is Binder Adjustments which are used when the contractor accepts this contract provision at letting time and then the price for HMA binder goes up or down by enough that the provision is invoked.

Contract Liens Related: This reason code is to be used when the item for contract liens is utilized. This item is used when INDOT is required to hold or payout money when there is a lien brought against a contractor because they are not making payments. The non-payment could be to sub-contractors, suppliers or others. When this occurs, this code will be used.

- **Incentive/Disincentive** - Incentive and Disincentive language is included in contracts to provide a financial motivation to a Contractor to complete work associated with a closure period, an intermediate completion date, or an early contract completion date. If such language is included in a contract, a Change Order is required to incorporate additional compensation earned by the Contractor, due to early completion of the required work, or a credit to the Department, in the form of Liquidated Damages, resulting from late completion of the required work. In addition, this reason code is also used for Change Orders which are necessary to incorporate a Contractor submitted Cost Reduction Incentive, CRI, into a contract in accordance with 109.04 of the SS.

Contract Completion: This reason code is used when the incentive payment or liquidated damage credit is a result of either completing the contract work before or after the contract completion date shown on the proposal page.

<u>Intermediate Completion</u>: This reason code is used when the incentive payment or liquidated damage credit is a result of either completing the contract work required before or after an intermediate completion date as shown on the proposal page of the contract.

<u>Closure Times</u>: This reason code is used when the incentive payment or liquidated damage credit is a result of either completing the contract work before or after the allotted number of days for a closure as shown on the proposal page.

<u>Cost Reduction Incentive</u>: This reason code is used when an incentive payment is made to the contractor for a percentage of a cost savings to the contract for an idea presented by the contractor. It is made in accordance with 109.04. An example of this would be where a 3-span bridge is to be constructed and the contractor presents a new design for the bridge that uses post tensioning elements and is only 2 spans and results in a savings of $500,000.00. If the redesign is approved, then the Contactor and INDOT split the savings and the contractor is paid on a change order using this reason code.

<u>A+B Contract</u>: This reason code is used when the incentive payment or liquidated damage credit is a result of either completing the contract work required on an A + B Contract. The cost associated with this work can be tracked and therefore not counted against the "On Budget" metrics.

<u>A+B+C Contract</u>: This reason code is used when the incentive payment or liquidated damage credit is as a result of either completing the contract work required on an A+B+C Contract. The cost associated with this work can be tracked and therefore not counted against the "On Budget" metrics.

- **Standards/Specifications Change -** The Department may elect to incorporate a new standard detail or specification change into a contract after it is let. In these situations, a Change Order is required to modify the contract to add the new standard detail or specification. There may be monetary or time adjustments associated with these types of Change Orders. The Standards/Specifications Change reason code should only be used when the directive for this change comes from Central Office normally as part of a Construction Memorandum. If a change is being made to a specification, special provision or standard by any other means, it would be a changed condition to the contract and fall under another reason code.

- **Final Quantity Adjustment -** This reason code is used on Change Orders which are required when the overruns or underruns for individual pay items result in monetary adjustments that exceed the thresholds included in the Change Order Policy. These are sometimes referred to as balancing Change Orders.

- **Damage to State Property** - This reason code is used on Change Orders that are a result of payments made to the contractor for repairs that are made to State property, normally as a result of a traffic accident. The cost associated with this work can be tracked and therefore not counted against the "On Budget" metrics.

- **Contract Renewal** - This reason code is used when the change order is for the renewal of the contract as allowed in the special provisions. Contract renewals are generally for an additional 365 days at a time for the number of renewals as allowed in the contract. These contracts are usually for mowing and traffic signal and lighting maintenance but could be for other types as well.

- **Maint. Of Traffic Safety Improvements** - This reason code is used for improvements made to the Maintenance of Traffic for the safety of the traveling public and field personnel. The cost associated with this work can be tracked and therefore not counted against the "On Budget" metrics.

- **Emergency Work** - This reason code is used for any repair work that requires immediate attention. This reason code will track costs and should not be considered towards the On Budget metric. The cost associated with this work can be tracked and therefore not counted against the "On Budget" metrics.

2.19.6 Recoverable and Non-Recoverable Change Orders and Delta Costs

The PEMS is required to document and classify all errors and omissions, E&O, change orders as either having recoverable or non-recoverable costs. Recoverable and non-recoverable information should be included in the Explanations portion of the Change Order **General** tab within AWP. The determination of the additional costs should be made prior to generating the change order.

PMs should be notified of all E&O change orders to help with resolution and to determine if the Consultant Designer may be held accountable for extra costs arising from the E&O. The PM, PEMS, and Consultant Designer may jointly collaborate to review and mitigate potential additional costs. If the PM decides the Consultant Designer is responsible for the additional costs caused by E&O (also known as the delta or premium costs), these costs are considered to be recoverable and the PM may decide if the Department will move forward with the collection of those costs from the Consultant Designer.

One example of how to figure the delta or premium cost is as follows:

The Consultant Designer incorrectly calculated the amount of QC/QA-HMA, 3, 58, Surface, 9.5 required to build the contract. They used an incorrect lay rate of 65 pounds per square yard instead of the required 165 pounds per square yard. Because of this mistake, the Consultant Designer listed a quantity of 5,910 tons of material needed when in reality the quantity needed/listed in the contract should have been 15,000 tons. The Contractor bid $85.00 per ton for the 5,910 tons shown. After a review of this Contractor's bid history for this item, it was found that if the correct quantity of 15,000 tons had been in the contract at time of letting, the Department should have received a bid price of $80.00 per ton for this item. Therefore, the difference in cost of construction of the contract is the following: (15,000 tons x $85.00 per ton) – (15,000 tons x $80.00 per ton) = $75,000.00 = delta or premium cost.

In this case, the delta or premium cost of $75,000.00 is the potential amount that the Department could recover from the Designer for the E&O. If this quantity change qualifies under 104.02(c)2 or 109.03 of the SS and the price is renegotiated with the Contractor, the renegotiated price would need to be reflected in the delta or premium cost to be collected from the Designer.

The cost to add the extra 9,090 tons at the contract unit price, $772,650.00, would need to be added on a change order with a reason code for E&O, Quantity Related, Major. The change order should be eligible for FHWA participation as long as this extra cost was not caused by "gross negligence". The change order, along with the information on the $75,000.00 delta or premium cost, should be communicated to the PM for consideration as part of the E&O Process.

Another example of how to figure the delta or premium cost is as follows:

The Designer did not properly coordinate the removal of the utilities present at the project site. The Designer did not take into account that there was a large fiber optic duct bank running where the new drainage system had to go on the project. (In this case it should be noted that it is being assumed that the Designer performed the utility coordination on the project.) Because of the Designer's lack of coordination and due diligence, the Contractor was delayed in starting the project by more than 6 months. As a result, the Contractor incurred a substantial increase in their project overhead costs and incurred escalated labor, equipment, and material costs in the completion of the project. The documented additional costs incurred amounted to $2,000,000.00.

The PM should have involved the Designer early on to see if there was a way to mitigate the problem by possibly redesigning the drainage system or by some other method. In this example, it is assumed that this was done and that the extra costs were unavoidable.

In this case, the calculation is straight forward and the entire $2,000,000.00 is an extra cost to the contract that could have been avoided if the Designer had performed the utility coordination as expected before the letting. Therefore, the entire $2,000,000.00 is the delta or premium cost that the Department could recover from the Designer for E&O regarding the utility coordination.

This extra cost would need to be added on a change order with a reason code for E&O, Utility Related, and would be marked as recoverable. In this case, the extra cost would not be considered eligible for FHWA participation.

In this example, it should also be noted that the assumption is being made that the Designer performed the utility coordination for this project. On other projects, the utility coordination could be performed by another consultant/coordinator or could be performed "in house". Therefore, it is extremely important to involve the PM early in the process. The PM will know who is performing this function on the contract and the amount and level of coordination that was required under the contract.

If the PEMS is unsure if an E&O is potentially recoverable or unsure of how to figure the delta or premium costs incurred because of an E&O, the issues may be discussed with the PM, the AE, the Central Office Field Engineer for the District, and/or Department's litigation attorneys.

2.19.7 Change Order Approval Authority

The Change Order Policy assigns Department approval authority based on the magnitude of the overall monetary or time adjustment involved. If a Change Order includes both monetary and time adjustments, the approval authority is the higher authority required for approval of either the monetary adjustment or time adjustment if considered separately.

The approval authority for a Change Order is based on the monetary adjustment and time adjustment associated with that document. The Change Order approval authority is based on the adjustments of each individual Change Order and is not cumulative throughout the Contract. It is possible for Change Order No. 1 to require SCE approval while it would be appropriate to approve Change Order No. 2 at the PEMS level.

Work associated with a Change Order cannot begin until documented approval is provided by the approval authority and has been coordinated with the PM. In addition to the Department approval authority, LPA documented approval is required for LPA contracts and FHWA documented approval is required on contracts specifying FHWA change order approval.

Where the Change Order document cannot be completed prior to work being performed, a work order and written documentation from the approval authority is required prior to work commencing. When major changes are involved, prior approval will be required, as discussed in 2.19.8.

There are three situations which require the documented approval of the DCM in addition to the approval authority based on the magnitude of the monetary or time adjustment. The situations are described below:

- Change Orders which involve work on property, equipment, buildings, or other items owned by the State of Indiana and not included in the original or modified contract.

- Change Orders which involve the purchase of equipment that will remain the property of the Department after completion of the contract.
- Change Orders which establish or delete intermediate completion dates, closure periods, etc.

2.19.8 Major Change Order Prior Approval

Prior approval is required before work can start on changes which are considered major changes. Major changes are significant changes to the cost, character, or scope of a contract which require a determination of whether the change would benefit from being competitively bid. These are defined as:

- Cost increase of 5% of the contract award amount or $250,000.00, whichever is less.
- Time extensions due to scope changes, or
- Changes in scope as given below:
    - Changes in contract beginning and ending locations.
    - Scope revisions due to a CRI proposal.
    - Alterations to the intent or scope of the contract or character of the work.
    - Revisions to the geometric design of the mainline roadway, ramps, frontage roads, or crossroads.
    - Revisions to the structural section of the pavement including, but not limited to, subgrade, subbase, performance graded binder grade, pavement type, pavement depth, individual pavement courses and aggregate designations, type, or quality of materials to be furnished, such as changing the individual aggregate base to an asphalt concrete material.
    - Additions, deletions, changes, or relocations to bridges or structures that affect the functional scope and intent of the approved design.
    - Revisions that result in new environmental impacts, changes in previously permitted activities, or reductions in environmental mitigation measures provided for in the contract.
    - Changes to limited access control lines.

All other changes that do not fall under the above categories are processed as minor changes and do not require prior approval.

Prior Approval Procedure. The PEMS should forward information related to the required Change Order work; the recommended monetary adjustment amount including all affected pay items, quantities, and unit prices; and the recommended time adjustment to the AE and PM via e-mail.

Within the email, include information related on how the recommended monetary and time adjustments were determined to be appropriate for the proposed scope of work. Examples of information to include are review of bid history, schedule information, any additional information provided, etc.

Attach additional documentation provided by the Contractor in the e-mail so it can be referenced by the approval authority. If the approval authority is above the AE level, the AE will review the packet prior to sending it to the DCD, and the process will be repeated by the Department approval chain of command until the information reaches the appropriate final approval authority. Each individual in the approval chain of command should indicate his or her concurrence with the recommendations until it reaches the final approval authority. This will ensure that everyone who will be involved in the Change Order approval process is informed regarding the situation and supports the recommended solution.

The Department approval authority will review the forwarded packet. If it is acceptable, the approval authority will provide the PEMS with documented approval of the Change Order via e-mail. After receiving Department, LPA, and FHWA approval via e-mail, if applicable, the PEMS will direct the Contractor via a Work Order to begin Change Order work. If additional information is required prior to Change Order approval, the approval authority will notify the PEMS and copy all in the approval chain via e-mail of the desired additional information. The PEMS will provide the desired information to the approval authority via e-mail and copy all in the chain of command below the approval authority.

If anyone in the approval chain of command does not agree with the recommended Change Order, it will be necessary to notify all individuals who have previously concurred with the recommendation, including the PM, of the denial and to determine the appropriate course of action. The individual who denied the recommendation may provide an alternate solution or reject the Change Order altogether. It will be necessary to work with the PM to seek the input of the appropriate individuals to verify the adequacy of an alternate solution or whether it will be necessary to perform this work on a future contract.

After all required Department and outside agency documented approvals are obtained, the Work Order sent to the Contractor should include the following information:

1. Date
2. Change Order Work Elements
3. Affected Existing Pay Items and Estimated Quantities
4. New Pay Items Established, Associated Quantities, and Unit Prices
5. Estimated Monetary Adjustment
6. Contract Time Adjustments to Affected Closure Periods, Intermediate Completion Dates, and Contract Completion Dates (if applicable)
7. Date Work is Expected to Begin

A sample Work Order is provided on the Construction Information website at: https://www.in.gov/indot/div/construction.htm.

Verbal Prior Approval on major changes may be obtained if an emergency or unusual condition exists. This verbal Prior Approval will be documented by the PEMS with an email.

2.19.9 Existing Contract Pay Item Overruns and Underruns

The Change Order Policy allows for individual existing contract pay items to overrun or underrun without processing a Change Order if both of the following conditions are met:

- The overrun or underrun of the pay item does not result from a change in scope of the contract.
- The monetary adjustment associated with the overrun or underrun of the existing contract pay item is less than $20,000.00.

If either of the above conditions is not met, it will be necessary to execute a Change Order to document the monetary adjustment associated with the overrun or underrun of the existing contract pay item.

Once a Change Order is executed to document a monetary adjustment related to the overrun or underrun of an existing contract pay item, a subsequent Change Order is not required until an additional monetary adjustment of $20,000.00 related to overruns or underruns of the pay item is reached, unless it is due to a change in contract scope.

2.19.10 Contract Scope/Design Element Change Orders

The Change Order Policy, located as an attachment to Construction Memo 22-08, requires that Change Orders involving changes to the scope or design elements of a contract are coordinated with the PM. The Change Order must receive approval from the party responsible for the design element involved in addition to the Change Order's required approval authority. This is necessary to ensure that contract specific design criteria or Department commitments made prior to construction are not changed without the input of personnel familiar with these issues. The Change Order Policy lists several such items which are considered changes in scope or design elements.

2.19.11 Determination of Required Change Order Work/Work Order Issuance

For situations involving a changed condition or any other change to the work initially involved in the original contract, it is the Department's responsibility to grant approval to the Contractor before additional work associated with a change order is performed. A Department signed Work Order is the proper method to authorize a Contractor to perform the work prior to full execution of the official change order document. A sample copy of the Department's Work Order can be found on the Department's website.

In order to begin the process of generating a change order with correct documentation, and prior to issuing a Work Order, the following steps are required:

- **Notify AE of Need for Change Order -** The AE needs to be notified of situations that could require a change order. Discuss the situation with the AE to determine if additional work and a change order would be necessary. The AE can provide assistance and direction with the change order process and can help determine what documentation will be necessary. They can also provide guidance on proper notification and communication with the PM for the particular situation.

- **Notify PM of Need for Change Order -** In order to properly manage the contract, the PM must be notified when change order situations occur. The notification should include the results of the discussions with the AE regarding the work associated with the change order. The PM should be kept informed as the change order work plan is developed and finalized.

  In situations where a change order is necessary due to a design error or omission made by a designer, the PM will initiate contact with the Designer for input regarding the required change order work. It is important that the PM is notified by the PEMS promptly of the error and omissions situation. The PM will then contact the Designer to involve them in developing possible solutions to mitigate the design error or omission condition. The Department's ability to potentially seek reimbursement from the Designer for the additional costs incurred due to the error or omission is based on timely notification of the PM, and the PM making timely contact with that Designer.

- **Obtain a Change Order Request Form –** Direct the Contractor to complete and submit a Change Order Request form, available from the Department's website, when appropriate. The completed form should identify unique circumstances, possible mitigating options, and provide an initial summary of the associated costs. The PEMS may require amendments to the form based on the Department's cost verification procedures described below.

- **Determine the Work Elements for the Change Order –** The change order work element details and associated pay items should be determined based on the PEMS' understanding of the particular situation, discussions with the AE, PM, Designer, and the information provided within the Contractor's submitted Change Order Request form. When available, information from other individuals or parties involved in the extra work should also be utilized in determining work elements and pay items.

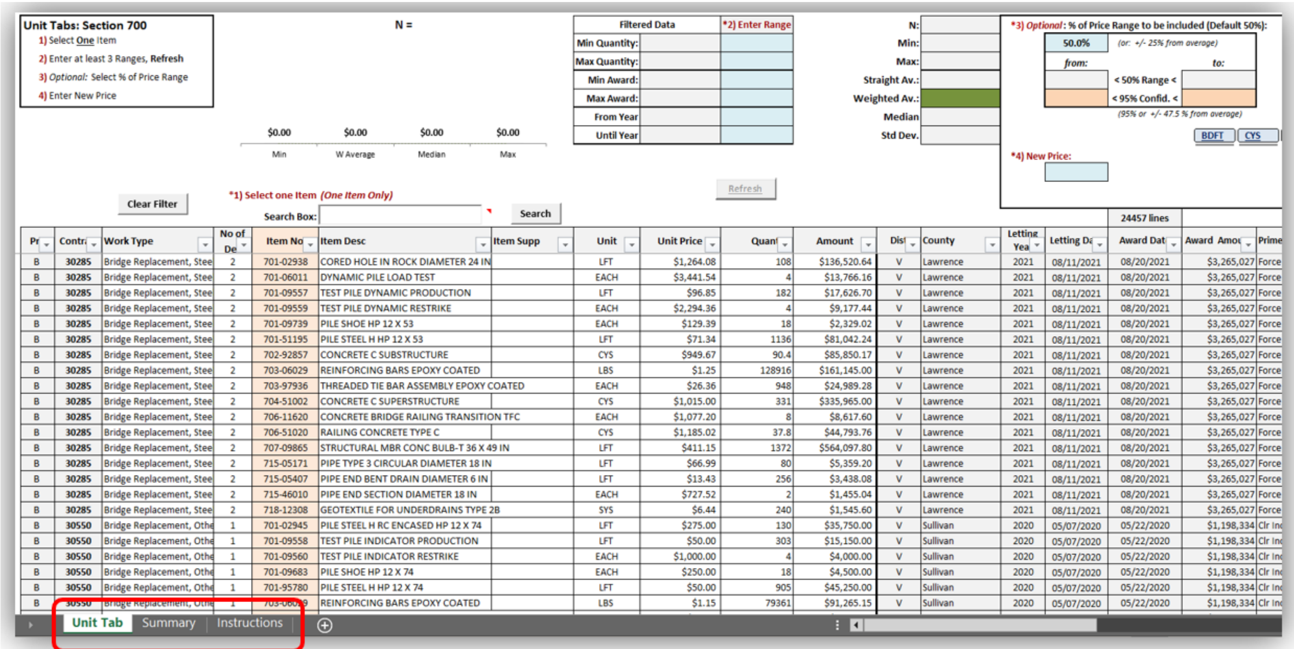
- **Determine the Change Order Monetary and Time Adjustments -** Once the change order work is determined and all required Contractor submittals are received, it is necessary to establish the monetary and time adjustments associated with the work. For work covered by existing contract pay items, the monetary adjustment is based on the estimated quantities and the existing contract unit prices. For work involving new pay items, the monetary adjustment is based on the estimated quantities and agreed upon unit prices. The copy of the Change Order Flow Chart is available at: https://www.in.gov/indot/doing-business-with-indot/home/construction-information

If the Contractor's proposed time adjustments apply to closure periods, intermediate completion dates, incentive/disincentive dates, etc. as well as the contract completion date, for approval purposes the requested time adjustment is the maximum duration. For example, if a Contractor requests time adjustments of 10 days to Intermediate Completion Date 1, 15 days to Intermediate Completion Date 2, 15 days to Intermediate Completion Date 3, and 15 days to the Contract Completion Date, the magnitude of the time extension request is 15 days.

For situations where a time adjustment is necessary to mitigate a delay which is the Department's responsibility and the mitigation results in application of a portion of the adjustment prior to December 1 and the remainder is applied after March 31 in accordance with the SS, the magnitude of the time adjustment is the number of calendar days that the intermediate completion or contract completion date was shifted, including the period starting December 1 and ending March 31. For example, if a 30 day, Department responsible delay was experienced on a contract with an intermediate completion date of November 15 and the SS permit the exclusion of the period beginning on December 1 and ending on March 31, the remaining fifteen days of the adjustment would be applied from April 1 to April 15. In this situation, the time adjustment requiring approval would be 151 calendar days, or 152 calendar days if a leap year is involved.

- **Perform a Cost Verification for New Pay Items** – A cost verification must be performed by the Department on all new pay items of extra work in accordance with Federal Code of Regulations, 23 CFR 635.120(e). The Department's Item Bid History spreadsheet should be the first step in the cost verification process.

  a) Item Bid History – The Department's Item Bid History spreadsheet utilizes a database of winning contract bids for all Department contract items over a span of several years. The Item Bid History spreadsheet process and associated filters can be used to obtain a meaningful representation of item unit prices based on particular contract situations. The filtered result establishes a weighted average within a confidence interval that can be compared to the Contractor's submitted price. Below is a sample of the spreadsheet's interface for the 700 section for structure pay items.



Item Bid History spreadsheet tabs

Currently, the Department's Item Bid History spreadsheet is accessed through the SiteManager Reports page and includes the following tabs located at the bottom left of the page:

1. **Unit Tab** – The main working area of the spreadsheet. Within this page, item identification, item filtering, and statistical confidence range calculations are performed.

2. **Summary** – This contains a summary of the item filtering and statistical confidence range calculations that have automatically been calculated on the Unit Tab page. The page also contains the forecasting tool which evaluates unit cost ranges for specific quantity values. Additional filtering is still available from within this page. The Summary page is intended to be saved and attached to the change order as part of cost verification documentation once the unit price comparison process has been completed.

3. **Instructions** – Provides basic instructions on the use of the spreadsheet. The page is for information only and acts as an aid to completing the spreadsheet.

The cost verification process begins by checking the Item Bid History spreadsheet to determine which of the following situations apply:

1. If there is no bid history for the pay item.
   If no item bid history exists, use one of the processes described under “Cost Analysis” explained below.

2. If there is a bid history.
   If there is a bid history, filter the data for contract conditions. The unit tab page contains 4 basic steps to achieve results. The steps are identified in the top left corner of the spreadsheet. These steps must be processed for the spreadsheet to function correctly and provide the appropriate unit price results.

3. If $N < 10$.
   If the N value is less than 10, it is statistically insignificant, and another method of cost verification should be utilized. It may be better to use one of the processes described under “Cost Analysis” explained below.

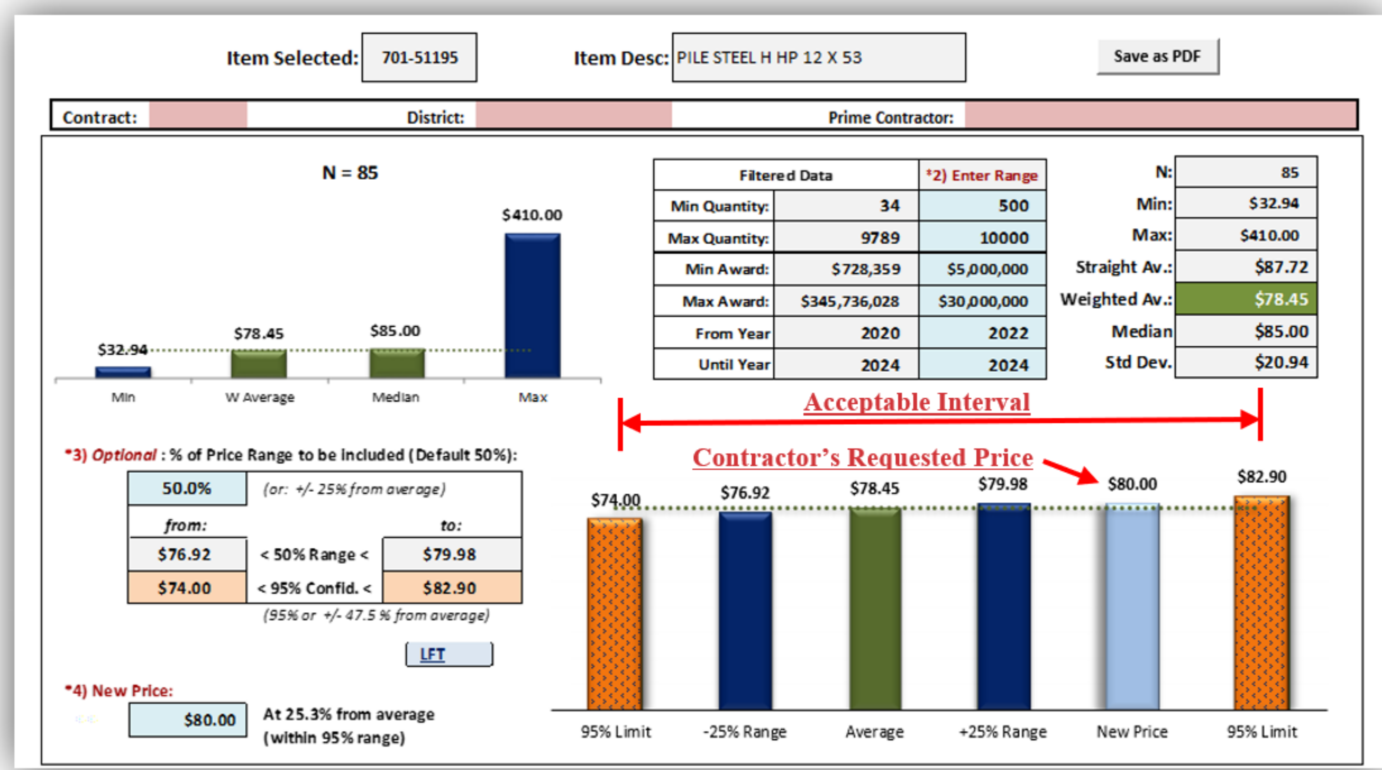
4. If $10 < N < 30$.
   If the N value is greater than 10 but less than 30, the unit price data returns cannot be directly utilized, but still may provide usable cost verification information. If the Contractor’s requested unit price is equal to or less than the weighted average, then the price is acceptable, and the cost verification process is complete. The PEMS must attach a copy of the Department’s Item’s Bid History summary page to the change order as cost verification documentation.

5. If $N < 30$.
   If an N value is less than 30. If the value is close to 30, the previous filters can be cleared and search filter can be expanded to reach an N value of 30 or greater.

6. If $N \geq 30$.
   N is the number of data lines returned for a filtered search within the Item Bid History spreadsheet. This value can be found above the min, average, and max graph. If the N value is greater than 30, the Item Bid History spreadsheet has an appropriate number of unit price data returns to be statistically significant and can be utilized for cost verification. Proceed to “Cost Comparison” below.

7. **Cost Comparison.**
   The filtered result establishes a weighted average unit price within a 95% confidence interval, or in other words, an acceptable unit price range.

In the example below, the acceptable interval is identified for values between $74.00 and $82.90. If the Contractor's requested unit price is within or below that interval, the unit price would be acceptable, and cost



verification is complete. The Contractor's requested unit price is $80.00 and is within the acceptable interval and is acceptable. The cost verification is complete. The PEMS must attach a copy of the Department's Item's Bid History summary page to the change order as cost verification documentation.

8. **Cost Comparison with Amendment.**
   If the Contractor's requested unit price is above the weighted average 95% confidence interval, the Contractor should be directed to amend the unit price, or to include additional information to clarify specific contract circumstances that justify the greater price. If the amended unit price is accepted, the item Summary page and the Contractor's unit price request, as amended, should be attached to the change order as item cost verification documentation and the cost verification is complete.

b) Cost Analysis – If the Department's Item Bid History indicates limited (N < 10) or no item bid history, data obtained from the spreadsheet should be used as informational only and one of the following cost analysis methods should be utilized for cost verification of requested prices.

1. ***Estimated Item Cost Less Than or Equal to $20,000***
   When verifying costs for new and unique items of approved extra work with an estimated item costs of less than $20,000 and having insufficient bid history, the Contractor's submitted Change Order Request form with any requested supporting cost breakdown documentation should be reviewed for acceptance by the PEMS and, as needed, the AE. The Change Order Request form should be reviewed for extra work identification and description, mitigating options, and cost accuracy.

2. ***Estimated Item Cost Greater Than $20,000 but Less Than or Equal to $250,000***
   When verifying costs for new and unique items of approved extra work with an estimated item cost greater than $20,000 but less than or equal to $250,000 and having insufficient bid history, the PEMS and, as needed, the AE will perform a cost analysis validation of the work for comparison with the Contractor's Change Order Request form and any requested supporting cost breakdown documentation. The Department's cost analysis will be documented on the Change Order Cost Analysis Validation form, available on the Department's website.

3. ***Estimated Item Cost is Greater Than $250,000***
   When verifying costs for new and unique items of approved extra work with estimated item cost greater than $250,000 and having insufficient bid history, the PEMS, AE, FE, and the Engineer of Record will work together to provide relevant information in the development of the cost analysis for the Department. All cost analysis input will be documented on the Department's Change Order Cost Analysis worksheet or similar cost estimating worksheet, as approved by the AE. The combined cost analysis information will be used to compare with the Contractor's Change Order Request form and any requested supporting cost breakdown documentation.

   This method can also be utilized when the construction activity components for approved extra work are too significant to track individually. Examples of this might include situations when 50 or more pay items are impacted by extra work, or when there is a complete phase or scope change.

For any of the cost verification methods described above, if the comparison is not acceptable, the PEMS should direct the Contractor to amend the Change Order Request form to provide additional detail on the uniqueness of the proposed work and the associated justification for the requested item price.

The accepted Contractor's Change Order Request form along with the Department's cost analysis should be attached to the official change order as new item price verification documentation.

- **Use of Force Account -** If prices for extra work cannot be agreed upon, change order work can be performed as a force account. The force account option should only be used as a last option to pay for approved extra work. Estimate the monetary adjustment in accordance with force account procedures outlined within the SS. The PEMS must explain the need to utilize the force account process within the change order.

  When utilizing the force account option, there are discussions with the Contractor that are required to occur prior to the agreement and authorization to perform the extra work. These discussions should establish the specifics on issues such as, but not limited to:

  1. Specific individuals that will perform the extra work.
  2. Hourly rates of pay, including fringes and benefits.
  3. Estimated time to complete the extra work including hourly work week and crew size.
  4. Specific bond and insurance premium costs for the extra work.
  5. Estimated quantity and cost of materials to be utilized, including transportation costs.
  6. Individual pieces of equipment to be used for the extra work.
  7. Agreement on the specific equipment rates to be paid.
  8. Appropriate sub-contracting administrative costs, in accordance with the SS, for force account work.
  9. Appropriate mark-ups, in accordance with the SS, for force account work.

In accordance with the SS, the Contractor and the PEMS are required to compare records of the completed force account work at the end of each day. The Contractor may submit a Force Account Daily Record form to the PEMS at the end of each day of work in either a hard copy or digital in pdf format. If the Contractor does not submit a form, one is available for use on the Construction Information website. The Contractor or the PEMS may populate the form with daily quantities of the following items:

a. labor,
b. materials,
c. rented and owned equipment, and
d. subcontractors and haulers.

The form is required to be reviewed and signed at the end of each day by both the Contractor and the PEMS. The PEMS will retain the original signed form and the Contractor will receive a copy of the form.

When completing documentation for force account change orders, the Force Account Daily Record forms for all applicable dates will be compiled and utilized as the basis for final compensation and verification of the Contractor's itemized statements of cost. All associated daily record forms are required to be attached to the change order in AWP along with the Contractor's itemized statements of cost, and any other summary documentation justifying the final force account payment amount.

If the actual force account costs exceed the initial estimate, a subsequent Change Order can be processed to cover the excess costs.

- **Rental Rate Blue Book as Published by EquipmentWatch -** For Contractor owned machinery or special equipment, the rates submitted for extra work shall not be more than those listed in the current Rental Rate Blue Book as published on the EquipmentWatch website. The website provides individual reports for construction equipment. Reports obtained from this site are known as EquipmentWatch Rental Rate Blue Book reports and are used when reviewing extra work in accordance with the SS.

  The Department only recognizes two rates in the report for extra work. The first rate is the FHWA Hourly Rate for active equipment being utilized for extra work. The FHWA Hourly Rate includes both hourly ownership costs and hourly operating costs. The second rate is the Standby Hourly Rate used for equipment standby time during the performance of extra work. Any other equipment on the jobsite that is inactive or unnecessary for performing the extra work is not eligible for compensation.

The Department will only pay for machinery, equipment, or tools with an FHWA hourly rate of greater than $2.00 per hour as listed in the Rental Rate Blue Book published by Equipment Watch®.

The Department will not pay for machinery, equipment, or tools which are not listed in the Rental Rate Blue Book unless there is a documented fair market value of greater than $2,000 per item.

a) EquipmentWatch Rental Rate Blue Book Report – The sample below is a typical EquipmentWatch Rental Rate Blue Book report for a Caterpillar 336 Excavator.

EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Key Information

Rental Rate Blue Book®

October 27, 2025

Caterpillar 336
Crawler Mounted Hydraulic Excavators

Size Class:
33.5 - 40.4 mt
Weight:
N/A

Configuration for 336

Bucket Capacity	**3.0 cu yd**	Horsepower	**311.0 hp**
Operating Weight	**81900.0 lbs**	Power Mode	**Diesel**

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	Weekly	Daily	Hourly	Hourly	Hourly
Published Rates	USD $16,705.00	USD $4,680.00	USD $1,170.00	USD $175.00	USD $55.67	USD $150.58
Adjustments						
Region (100%)	-	-	-	-		
Model Year (2025: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $16,705.00**	**USD $4,680.00**	**USD $1,170.00**	**USD $175.00**	**USD $55.67**	**USD $150.58**

A

FHWA Hourly Rate

Non-Active Use Rates

B

	Hourly
Standby Rate	USD $55.10
Idling Rate	USD $117.16

Standby Rate

Rate Element Allocation

Element	Percentage	Value
Depreciation (ownership)	32.83%	USD $5,483.42/mo
Overhaul (ownership)	41.95%	USD $7,007.37/mo
CFC (ownership)	15.95%	USD $2,664.31/mo
Indirect (ownership)	9.28%	USD $1,549.89/mo
Fuel (operating) @ USD 3.77	39.97%	USD $22.25/hr

Revised Date: 4th quarter 2025

Equipment Watch Rental Rate Blue Book Sample Report for Caterpillar 336 Excavator

At the top of the report, under the Rental Rate Blue Book heading, **key information** such as size class, gross weight, and equipment configuration can be found. This information should accurately represent the equipment performing the extra work. The Contractor submitted equipment reports do not need to exactly match the equipment on the project, but they should be reasonably close. Since the construction equipment industry is so large, not every make and model has been categorized and assigned a value within EquipmentWatch.

The middle section of the report, under the Blue Book Rates heading, shows associated Contractor costs for owning a piece of equipment. Adjustments are applied by the Contractor to prorate these costs over the time the equipment is expected to operate on the project. Adjustments for region, specifically for Indiana or their localities, and model year should be included.

When reviewing extra work costs from the Contractor, the rate charged shall not be more than the **FHWA Hourly Rate**, (**A**). The FHWA Hourly Rate is equal to:

$$\left(\frac{\text{Adjusted Monthly Ownership Cost}}{176}\right) + (\text{Hourly Estimated Operating Cost})$$

For the example shown above:

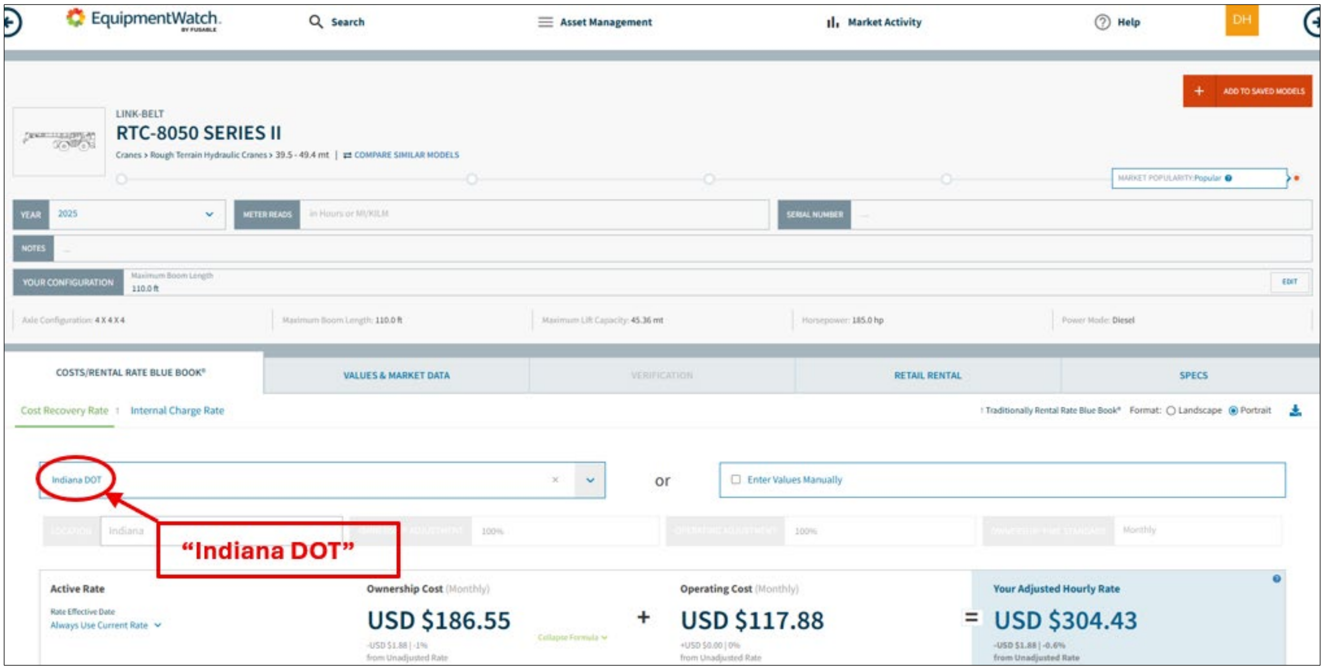
Adjusted Monthly Ownership Cost = $18,284.77
Hourly Estimated Operating Cost = $70.60

This value is automatically calculated within the report.

b) **Standby Equipment Rate Determination** - When the Contractor submits costs for standby equipment costs, the rate charged shall not be more than the **Standby Rate**, (**B**). The Department allows a standby rate for equipment used for extra work if **all** the following conditions apply:

- the equipment must be operational,
- on-site,
- necessary to perform controlling operation work, and
- remains idle due to conditions beyond the control of the Contractor.

To confirm the region within the EquipmentWatch website, select Indiana DOT from the drop-down menu list of State DOTs as shown below.



The standby rate will also apply during periods of transportation and on-site assembly and disassembly of the equipment.

Standby time will not be considered for payment when the equipment is being used:

- more than 8 hours per day, minus any hours paid for at the FHWA rate, or
- 40 hours per week, minus any hours paid for at the FHWA rate.

c) **Accessing the EquipmentWatch Website** - Internal personnel should receive a welcome email from EquipmentWatch.com, providing access to a new account and directions on how to finish setting it up. Consultant inspection does not have website access.

To access the new account, follow the below steps:

- Go to https://app.equipmentwatch.com/
- Click on SIGN IN in the top right corner of the page.

If a welcome email wasn't received, request access by selecting the Construction Management Support Inquiries form link and complete your request. CMSupport will then request access on your behalf.

Do not share your username or password to the EquipmentWatch website with others. Sharing your login credentials will lead to suspension of your user account.

To learn more about searching for equipment, refer to the help tab at the top corner of the EquipmentWatch page and navigate to the **Getting Started** video.

d) Rented Equipment - If equipment is rented rather than owned, the Department uses the Contractor's actual paid invoice rates from the supplier for the duration of work or standby period to determine the rate costs. During the period of equipment rental, the actual rental costs continue whether the equipment is in use or on standby.

For rented equipment, either the actual fuel, lubricant, and transportation costs incurred by the Contractor or the fuel percentage, indicated under the **Rate Element Allocation** heading of the EquipmentWatch Rental Rate Blue Book report, may be added to the rental cost.

- **Obtain Documented Approval -** After the monetary and time adjustments for the Change Order are determined, refer to the Change Order Policy to determine the required approval authority for the Department. In addition, obtain documented approval from representatives of the LPA or FHWA, if applicable, prior to issuing the Work Order directing the Contractor to perform the Change Order work.

- **Other Change Order Issues -** After documented approval of the Change Order work is obtained, forward information regarding the Change Order scope, affected pay items and quantities, and the unit prices to DO EEO and to the PM.

2.19.12 Execution of Change Order Document

After issuance of the Work Order, it is important to execute the Change Order document as quickly as possible. Since the Contractor cannot be paid for work associated with new pay items included in a Change Order until the document is fully executed, completing the Change Order approval process must be a top priority. In addition, while the Change Order is being processed, verify that the purchase orders associated with the work have sufficient funds to allow for payment of the Change Order work. If insufficient funds remain in the purchase orders, initiate the process to add the necessary funds.

The following instructions are intended to provide points of emphasis regarding the Change Order execution process (*See* SiteManager Training Document for more detail):

- **Generate AWP Change Order Information Entry -** The first step in the change order generation process is the entry of necessary information within the Change Order module in AWP. Under the **Construction** heading of the hoe screen, choose the **Change Oder** menu selection. Select the Component Action Items down arrow to activate the drop-down menu items. Click on **Select Contract to Add Change Order** menu item. Select the appropriate contract or type the contract number in the search bar. Select **Create Change Order on Contract** at the lower right of the window. The data associated with pay items and quantities must be entered in accordance with the PCNs under which the work will be performed. Time adjustment data is entered on a contract basis, but separate entries are required for each closure period, intermediate completion date, contract completion date, etc.

- **Entering Information –** There are three fields in the General change order tab that need to be completed by the PEMS. The three areas include the **Description**, the **Change Order Type**, and the **Reason** for the change order. These three fields are identified by red asterisks next to the titles. In order to identify recurring Change Order patterns, it is necessary for the correct reason code to be selected for the Change Order. Criteria for determining reason code categories appear earlier in this document. Using these categories, select the most appropriate subcategory to describe the situation related to the Change Order. All possible reason codes appear on a drop-down menu within the **Reason** location of the AWP change order module.

- **Scan Appropriate Change Order Attachments into AWP -** The documented approvals received from the Department approval authority, PM, FHWA, or the LPA, as applicable, should be scanned into AWP as attachments to the change order. In addition, documented approvals required from the DCM for the special situations listed in the Change Order Policy should be scanned into AWP.

- **Document Cost Analysis Process for Change Orders with New and Unique Pay Items -** Change Orders which include new and unique pay items are required by the Federal Code of Regulations, 23 CFR 635.120 to have a cost analysis performed. To document this requirement has been met, cost verification should be included as an attachment to the change order that indicates that the unit prices for all new pay items have been reviewed and found to be reasonable.

- **Document Force Account Process for Change Orders -** If force account is utilized, a valid reason must be given for performing the work under force account. Select “FA” within the drop-down menu for Change Order Type. This will identify the change order as one involving force account work. Any additional reasons can be added to the general explanation of the change order. Scan all documents required by Standard Specification 109.05(b) for force account work into the change order for AWP.

- **Document Time Adjustments for Change Orders –** Contract time must be mentioned in the explanation for any change order. Use one of the three responses detailed in section 2.18.1. Any time adjustment must be analyzed against the approved schedule and an explanation provided as to how the critical path was delayed. Scan the approved project schedule and any other correspondence into the change order.

- **Place Change Order in Pending Approval Status -** Prior to beginning the actual approval process, it is necessary to revise the change order status to "Pending Approval". Verify that the noted Department approval authority level is correct. If not, contact the DO for additional guidance. Once it has been determined that the Department approval level is correct, select the appropriate individuals for the AE, DCD, SCE, and DCM menus as appropriate.

- **Produce Change Order Hard Copy for Contractor Signature –** Since the Contractor does not have access to AWP, it is necessary to produce a hard copy of the Change Order and scanned documented approvals so that the Contractor's approval can be noted by signature. **Do not share any bid history data or operation production data from the cost analysis file with the Contractor**.

- **Document Contractor Approval in AWP Change Order Module -** Upon receipt of the Contractor signed Change Order hard copy, indicate the Contractor approval of the Change Order within AWP. Scan the Contractor signed change order hard copy into AWP. If no LPA approval is required, maintain the Contractor signed hard copy in the Intelligent File Cabinet contract file.

- **Forward Contractor Signed Change Order Hard Copy to LPA, if Applicable** LPAs do not have AWP access, so forward the Contractor signed hard copy to the LPA for official representatives' signatures on LPA contracts.

- **Document LPA Approval in AWP Change Order Module, if Applicable -** Upon receipt of the LPA signed change order hard copy, if applicable, indicate LPA approval of the change order within AWP. Scan the LPA signed hard copy into AWP and maintain the hard copy in the Intelligent File Cabinet contract file.

- **Obtain Department Approval -** If the PEMS is the approval authority, approve the change order within AWP. If the contract has FHWA oversight, notify FHWA that the change order is available within AWP for FHWA review via e-mail. If the contract does not have FHWA oversight, the change order approval process is complete.

  If the approval authority is at the AE level or above, notify the AE via e-mail that the change order is ready for approval. If the AE is the Department approval authority, the approval process is complete once AE approval is granted unless the contract has FHWA oversight. For FHWA oversight contracts, the AE notifies FHWA that the change order is available for review within AWP via e-mail.

  For change orders with an approval authority above the AE level, each individual within the approval chain will recommend the change order for approval and forward it to the next level until the change order is approved by the approval authority. Once the change order is approved by the approval authority, the change order approval process is complete unless the contract has FHWA oversight. If the contract has FHWA oversight, the approval authority needs to notify FHWA that the change order is ready for review within AWP.

If anyone in the approval chain requires additional information prior to approving the change order, the PEMS will be contacted and notified of the required additional information. While preparing the requested additional information, modify the change order status back to "Draft". Once the requested additional information is forwarded to the individual that requested it, change the status of the Change Order to "Pending Approval" and notify the AE that the change order and additional information is ready for the approval process.

- **Distribute Copies of Executed Change Order to All Signatories -** After all required approvals have been obtained, supplement the Change Order/attachment hard copy that includes the Contactor signature and LPA signatures, if applicable, with a AWP generated Department approval page to serve as the original change order document. Maintain this document and attachments in the Intelligent File Cabinet contract file. From this original document, produce hard copies of the change order and all attachments for distribution to:

    1. Contractor
    2. LPA (if applicable)
    3. FHWA (if applicable)
    4. District Office file
    5. Project Manager.

2.19.13 Documentation Requirements

Change order related correspondence exchanged between the Department and the Contractor should be retained by attaching the documentation to the respective change order within AWP. It is acceptable to scan these documents into AWP or maintain them in the Intelligent File Cabinet contract file as long as the document location is noted on the Correspondence Log. Following are examples of documents related to change orders which should be entered, as applicable, to the change order:

a. Contractor's Change Order Request submittal,
b. Cost verification information,
c. Any necessary drawings,
d. Any necessary calculations,
e. General correspondence,
f. Contractor's signature on the change order,
g. Project Manager correspondence,
h. FHWA approval correspondence, as required,
i. Other documents explaining the creation of the change order and how the price and quantity were determined.

2.20 CLAIMS

Situations which result in Contractor claims for additional compensation or contract time can be very complicated. It is not possible to provide clear instructions for handling every situation that can potentially result in a claim. Therefore, the following discussion will be limited to certain concepts that are common to claim situations.

2.20.1 Changed Conditions

Contractor claims will only be considered when they are related to a changed condition as defined in 104.02 of the SS. There are three types of changed conditions:

- Differing Site Conditions
- Suspension of Work Ordered by the Engineer
- Significant Changes in the Character of the Work.

In most cases, when there is a potential changed condition situation on the contract, it is discovered by the Contractor. Therefore, the Contractor will be responsible for providing written notice of a changed condition.

Upon receipt of the Contractor's notice of changed condition, investigate the situation to determine whether any of the provisions of the SS apply. If necessary, direct the Contractor to stop work in the area of the possible changed condition to allow for the investigation. Refer to 104.02(d) for timeframe requirements for response to the Contractor.

If the situation is complex and it is not possible to respond within the stated timeframe, work with the Contractor to agree on an acceptable extended deadline.

If it is determined that the situation does not meet the SS requirements for a changed condition, notify the Contractor of that determination and direct the Contractor to proceed with work in accordance with the current contract requirements. This notification should be by e-mail.

If it is determined that the situation meets SS requirements for a changed condition, it is also necessary to determine the scope of the work required to mitigate the changed condition. If necessary, contact the AE or PM and request that the appropriate Department or Consultant personnel are contacted for assistance in developing the required scope of work. Once the scope of work is determined, notify the Contractor in writing of the changed condition determination and of the scope of work required to mitigate the problem. An e-mail is the preferred form of written communication for this notification.

If the Contractor accepts the determination made by the PEMS, prepare and execute a Change Order in accordance with the Change Order Policy for incorporation of the following:

- Addition of new pay items related to the mitigation scope of work to the contract.

- Adjustment of quantities associated existing pay items.
- Time adjustments associated with the performance of the mitigation work.

2.20.2 Contractor Notice of Intent to File Claim

If the Contractor disagrees with any portion of the determination of a changed condition or the mitigation scope of work, a Notice of Intent to file a claim must be submitted in accordance with 105.16(b) of the SS. This notice needs to describe the extent of the disagreement with the changed conditions finding so that tracking of the disputed costs and time can be performed. If there is no mention of the extent of the dispute in the Contractor's notice, request that it be provided as soon as possible.

Once the Notice of Intent is filed and the extent of the dispute defined, the Contractor is required by 104.02(d) to submit weekly reports while the disputed work is being performed to document the additional costs and time associated with the performance of this work. While this disputed work is ongoing, it will be necessary to track the labor, equipment, and materials used and document this information in the AWP diary on a daily basis.

On a weekly basis, meet with the Contractor to compare the AWP diary records to those included on the Contractor's weekly report. At the conclusion of the meeting, generate a report indicating all agreements and disagreements and maintain the report with comments in the Intelligent File Cabinet contract file. If the Contractor submits written notice of disagreement with the AWP diary entries, maintain this information in the same contract file. The importance of documentation and organization cannot be overstated. "If it is not written down, it did not happen" is a common statement made by individuals experienced in claim review.

Once the disputed work is completed, the Contractor must submit their claim within the timeframe included in 105.16(b). Review the claim against the documentation requirements and provide the Contractor with written acknowledgement of receipt of the claim. An e-mail is the preferred method for this notification. Any deficiencies in claim documentation should also be noted.

Timeline documentation of the claims process can be tracked using the District Claims Worksheet available on the Construction Information area of the Department's website.

2.20.3 Project Level Review

The PEMS is required to perform the project level review. While performing this review, keep the following in mind:

- Perform the review absent of emotion. The claim is to be evaluated on its contractual merits. Use factual information only.
- LPA contracts require involvement by a representative of the LPA and possibly an MPO in the claim review process.

- FHWA oversight contracts require FHWA representative participation in the claim review process.

- In accordance with the SS, the burden of proof for additional compensation or contract time is on the Contractor. This concept applies to providing contractual justification for entitlement as well as documentation of the magnitude of the additional compensation or contract time to which entitlement is demonstrated.

- Claims may ultimately result in litigation. It is important that the claim review process is performed in accordance with contract requirements and in a professional manner. All claim reviewers may be asked to testify under oath in a deposition or at trial.

- The AE and FE assigned to the District are available resources for the claim review. Complex situations may require the involvement of the Department's Legal Division.

- The review should focus on:

  a. Entitlement - Is the Contractor contractually entitled to monetary or time adjustments for performance of the disputed work? If there is no contractual entitlement, it is not necessary to evaluate the impact or cost aspect of the disputed work.

  b. Impact - Did the event that generated the disputed work impact the Contractor's controlling operation or critical path?

  c. Costs - What is the magnitude of additional costs and time incurred by the Contractor due to performance of the disputed work?

Upon conclusion of the project level review, prepare a written determination and forward it to the Contractor. The determination should include contractual justification for the determination, if possible. For situations where the Contractor does not demonstrate contractual entitlement, it is acceptable to cite this as justification for denial.

If the project level determination indicates that the Contractor is entitled to a portion of the monetary or time adjustments being sought, prepare and execute a Change Order in accordance with the Change Order Policy to settle as much of the claim as possible. If the Contractor's representative will not sign the Change Order because they intend to pursue the denied portion of the claim, notify the AE for guidance.

2.20.4 District and Central Office Reviews, Mediation, and Litigation

Detailed requirements for reviews of claims occurring above the project level between the Contractor and the Department are included in 105.16(c) of the SS. There are situations where all higher level reviews are performed in the District Office and there are others where Central Office review is required.

If the Contractor provides notice that a DO review is desired, forward the original claim submitted by the Contractor and the project level determination to the DO. While the DO or CO review is ongoing, provide any additional information requested.

If the claim or any portion is resolved at any of these levels, prepare and execute a Change Order in accordance with the Change Order Policy to facilitate payment of the monetary adjustment or modify the contract time in accordance with the time adjustment.

2.20.5 AWP Documentation Requirements

AWP includes a Claims/Liens identification area within the **CHANGE ORDER** module which allows for tracking the status of claims. When the Contractor's claim document is submitted, input the required claim information into the module. Contractor submittals of Notice of Changed Condition, Notice of Intent to File a Claim, or submittal of weekly claim forms do not warrant data entry into the Claims/Liens identification area. AWP automatically numbers each claim as it is initially entered into the area. No additional information is required to be input until the claim is resolved. At the time that the claim is resolved, input information related to the settlement amount and settlement date into the area.

When executing a change order that incorporates the claim settlement into the contract, "**CLM – CLAIM RESOLUTION**" should be chosen for the **Change Order Type** within the AWP Change Order module Associate the claim number within the **Description** of the change order.

There may be situations where claims are partially resolved at various steps in the claims resolution process. When partial resolutions are reached, the PEMS is required to prepare and execute change orders to incorporate the partial settlement into the contract. Input the claim number in the Description and Explanation entry areas to associate the change order to the claim. It is necessary to keep track of the monetary and time adjustments associated with each partial resolution outside of AWP until the claim is totally resolved. At that time, input the sums of all monetary and time adjustments into the AWP Change Order module to complete the data entry associated with the claim settlement.

2.21 COST REDUCTION INCENTIVES, CRI

Contractors may propose to modify contract documents to reduce construction costs without impairing essential functions, characteristics, and timing of the project. A Contractor's proposal must be in accordance with the SS.

The three components of payment for a CRI accepted by the Department include:

1. Contractor's Reasonable Design Cost for the CRI proposal
2. Cost of the work
3. Fifty percent of the department's net saving, in accordance with 109.04 of the SS:

TNS = OCW – RCW – CRDC - DC

Where:

TNS	=	Total Net Savings
OCW	=	Original Cost of the Work required by the original contract
RCW	=	Revised Cost of the Work
CRDC	=	Contractor's Reasonable Design Cost for the CRI proposal
DC	=	Department's Cost for investigating, evaluating, and implementing the CRI proposal.

<u>EXAMPLE:</u>

*The Original Cost of the Work (**OCW**) required by the original contract is: $200,000.*

*The Revised Cost of the Work **(RCW)** is: $100,000.*

*The Contractor's Reasonable Design Cost **(CRDC)** for the CRI proposal is: $20,000.*

*The Department's Cost **(DC)** for investigating, evaluating, and implementing the CRI proposal is: $10,000.*

The PEMS would make a payment for the CRDC of $20,000 after approving the formal proposal.

*Total Net Savings (**TNS**): $200,000 - $100,000 - $20,000 - $10,000 = $70,000.*

The Contractor's 50 percent share of the net savings: $70,000/2 = $35,000.

Total CRI Payment to the Contractor: $20,000 + $35,000 = $55,000.

The Contractor's Reasonable Design Cost for the CRI proposal, as well as the costs incurred by the Department in investigation and evaluation of the plans and contract, will be deducted from the total estimated savings of an accepted proposal. The PEMS should work with the PM and the Designer to determine the Department's Cost, as well as determining if the Contractor's Reasonable Design Cost is acceptable. The resulting net savings is split equally between the Contractor and the Department. Time savings resulting from the CRI should not be included in the calculation of net savings.

The intent of the CRI is for the PEMS to generate a change order to compensate the Contractor for their submitted Reasonable Design Costs just after approving the formal proposal. In cases when the Department has not initially paid the Contractor for development costs, or when the time frame between the development and completion of work is very short, the design cost and savings payment can be performed under one single change order. It is important that all costs are carefully documented on the change order. Whether completed under separate change orders or one change order, the development costs and the payment for 50% of Department savings to the Contractor should be paid in accordance with 109.04. The change order should adjust contract time and interim completion dates as required.

2.22 BUY AMERICA (STEEL AND IRON PRODUCTS) AND BUILD AMERICA/BUY AMERICA

The Department's Buy America requirement applies to both State and Federally funded contracts where permanently incorporated, domestically purchased steel and iron materials are planned to be used in the contracts. All contracts must incorporate domestically produced steel and iron products in accordance with IC 5-16-8 and 23 CFR 635.410.

For Federally funded contracts, the Build America/Buy America certification requirements apply. These requirements are outlined in Construction Memo 25-07, RSP 106-C-277, and 2 CFR part 184. Both the construction memo and the RSP documents are available on the Department's website. Additionally, M&T has a spreadsheet available for field use that helps determine whether a product or material is categorized as an Iron or Steel product, a Construction Material, or a Manufactured Product. This document is available on the M&T website.

All Buy America and Build America/Buy America certifications for State and Federally funded contracts must be submitted by the Contractor for each pay item containing qualifying products or materials prior to those products or materials being incorporated into the contract. A single all-encompassing Buy America or Build America/Buy America certification covering multiple pay items is not acceptable. Contractors should account for the use of domestic products and materials at the time of bid.

2.22.1 Minimal Use of Foreign Steel Regulation

Indiana code provides a provision for the potential use of foreign produced steel and iron materials when there is documented information on the insufficient supply of domestic steel and iron. The CFR allows for a minimal amount of foreign steel and iron to be incorporated into the work if specific requirements are met. The CFR requirements state that a minimal amount of foreign steel may be permitted, upon a waiver request made by the Contractor, if the greater of either:

a. the total cost of all foreign sourced products used in the contract, as delivered to the project site, is less than $2,500, or
b. one-tenth of one percent (0.1 percent) of the total contract amount is met.

The Department may elect to use the minimal foreign steel regulation at its discretion. The Contractor shall not dictate the use of the potential minimal quantities.

The PEMS should work with Contractors and Manufacturers to help answer questions on Buy America and Build America/Buy America compliant products and certifications. It is not the responsibility of the PEMS to find compliant materials and products, only to help answer questions on compliance issues. Once all potential substitution options have been exhausted, the PEMS should request that a Buy America Minimal Use Form be completed by the Contractor. A fillable form will be made available by the Department after discussion with the AE and the respective FE. Once the Minimal Use form has been completed and received from the Contractor, the PEMS will provide a copy of the document to the AE. The AE and respective FE will then review the form and determine if the foreign material is acceptable for use. If the request is determined to be acceptable to the AE and FE, the PEMS will submit the form to their respective DMTE as additional documentation for material acceptance.

2.22.2 AWP Documentation Requirements

All Buy America and Build America/Buy America certifications are required to be uploaded into AWP as part of the material certification requirements for each applicable pay item. An AWP template (template SMI004) is available for every material code that would result in the permanent incorporation of steel or iron products, construction materials, or manufactured products into the contract. A review of the Contract Sample Checklist report for the contract will help identify those items that require a Buy America or Build America/Buy America Certification.

Material Change Example:

Detectable warning elements can be either cast iron, brick, or fiberglass. If the Contractor chooses to provide fiberglass detectable warning elements, a Buy America Certification will not be required for a State funded contract. For a Federally funded contract, the fiberglass detectable warning elements would require a Construction Materials certification, in accordance with the M&T Build America/Buy America materials spreadsheet. The PEMS would enter the appropriate material certification into the AWP materials section.

2.23 DEMOLITION WORK

If the contract involves demolition work, the PEMS must give the Contractor written notification when parcels become available for demolition. This information will be furnished to the DO by the Land Acquisition Section of the Real Estate Division.

The Contractor should be assessed liquidated damages when demolition work does not commence within 5 calendar days or is not completed within 60 calendar days, in accordance with 108.08 of the SS. Inspection and testing for asbestos presence or filing a notification with the IDEM will be considered as part of the work. Copies of these filings must be dated and included in the final records for the contract.

An example of the Contractor’s “NOTICE TO PROCEED WITH DEMOLITION WORK” notification letter is shown below.

NOTICE TO PROCEED WITH DEMOLITION WORK

Contract # ___________________

District # ____________________

Contractor ____

Gentlemen:

This is to inform you that the demolition on parcel(s) ________________________ can begin on ______________________________. This date constitutes your official written notification in accordance with the standard specifications. Work is to commence within 5 calendar days after the date specified above. Liquidated damages will be assessed beginning on the 6th day.

____
Project Engineer/Supervisor

cc: District Construction Engineer
Contract File

Section 3:

Stormwater Management and Earthwork Operations

SECTION 3 – STORMWATER MANAGEMENT AND EARTHWORK OPERATIONS

3.1 STORMWATER MANAGEMENT

The SS require the Contractor to schedule and conduct its operations to minimize erosion of soils and to prevent sediment from reaching streams, irrigation systems, lakes, reservoirs, etc. The discussion of stormwater management must be included in all pre-construction conferences. The requirements for scheduling seeding and sodding operations should be emphasized when discussing these operations with the Contractor during the pre-construction conference and at all progress meetings and as construction progresses.

The CSGP, Construction Stormwater General Permit, defines the State's regulations governing stormwater management for land-disturbing activities affecting one or more acres. These regulations are the responsibility of IDEM to enforce. Compliance with these regulations is the responsibility of the Contractor and the Department.

The PEMS should have a thorough understanding of good stormwater management and the best management practices, BMP, utilized by the Department. The PEMS should also understand the processes by which the Department obtains approval from IDEM to perform construction projects under the CSGP and the requirements placed on the Contractor for stormwater management within the contract documents.

The Department's stormwater BMPs are defined within the SS, the Standard Drawings, and the contract plans. The Department's Construction Stormwater Management Field Guide, available on the Stormwater website, is an excellent reference for BMP implementation. The PEMS should review this information to understand the purpose and scope of stormwater control establishment for the contract. The IDEM Storm Water Quality Manual also provides excellent reference information for review by the PEMS to help ensure the project is in compliance with any contract required waterway permit and, if applicable, the CSGP. It is advised that the PEMS retain a copy of any contract required waterway permits for review and reference.

3.1.1 Purpose

The purpose of stormwater management is to minimize or eliminate the potential for soil erosion and off-site sedimentation. At its core, stormwater management has two basic processes.

The first core process is erosion control. Erosion control measures are designed to maintain the soil on the ground, to keep the soil within the construction area, and to minimize its movement. Erosion control measures are more cost effective than trying to manage sediment after it has begun to move. Minimizing water or wind produced movement of soils from stockpiles, new embankments or ditch lines would fall within the erosion control category.

The second core process is sediment control. Sediment control measures are designed to slow the movement of water to allow time for sediment particles carried by the water to settle and drop out of suspension. Sediment control measures are generally more expensive, require more maintenance, and are a less effective stormwater management tool. The management of soil particles moving with stormwater during a rain event would fall within the sediment control category.

3.1.2 INDOT's Stormwater Pollution Prevention Plan, SWP3
ES works with the Designer and IDEM to obtain approval to publish the NOI prior to letting a contract that will disturb one or more acres of land. The Designer develops an initial SWP3 to address anticipated land-disturbing activities within the construction limits during the contract. Prior to contract letting, the plan is reviewed by ES, and occasionally by IDEM. Revisions are made as necessary to provide a workable plan that ultimately becomes part of the contract documents.

Below is a chart indicating the stormwater requirements of any particular contract based on the permits necessary for that contract.

		2. Contract Requirements				
		Site Plan	SWQCP	SWQM	Weekly Inspections	Rain Event Inspections
1. Contract Permits	CSGP	N/A	Yes	Yes	Yes	Yes
	Waterway Permits	Yes	N/A	Yes	N/A	N/A
	No Permits	Yes	N/A	N/A	N/A	N/A

Contract Stormwater Requirement Matrix

3.1.3 Contractor's Stormwater Quality Control Plan, SWQCP
Plans are incorporated into the contract to address the anticipated needs for stormwater management during the different phases of the construction contract. However, since the Designer, ES, and IDEM cannot foresee the exact methods and sequence of operations the Contractor may use on a given project, the SS require the Contractor to develop and submit for acceptance a SWQCP to the PEMS describing the sequencing, prosecution, and phasing of the work for each stage of the construction contract. The SWQCP shall be prepared and stamped by a licensed engineer that holds a current certification for a Certified Professional in Erosion and Sediment Control, CPESC, or an approved equal.

The Department's design developed SWP3 and the Contractor's developed SWQCP shall work in coordination to satisfy the requirements of the CSGP.

The SWQCP, or any phase of the SWQCP, shall be submitted 14 calendar days prior to the start of any land-disturbing activities for that particular phase.

The SWQCP must address, at a minimum, the list of requirements within the Stormwater section of ITM 803.

The SWQCP is a “living” document and is required to be amended by the Contractor as new situations occur or as the plan of operation changes.

Once the SWQCP is received from the Contractor, the PEMS will perform the following:

(a) Review the SWQCP within 14 calendar days of receipt utilizing the process outlined in ITM 803, Section 15 and the SWQCP checklist within Appendix I.

(b) Contact the AE for clarification and utilize the District Stormwater Specialist as an information reference for the SWQCP review.

(c) Sign and date the SWQCP to document the review of the methodology and the content.

In addition to the work covered by the contract documents and the SWQCP, the Contractor may also need to operate offsite borrow and disposal sites. Waterway permits for these sites are solely the responsibility of the Contractor and are not covered in any part by the Department’s SWP3, the plans, or the contract permits. 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 PEMS prior to operations at those sites.

3.1.4 Installation, Inspection, and Maintenance

As defined within the SS, the Contractor is responsible for the proper installation, inspection, and maintenance of all stormwater management measures. In accordance with the CSGP, rain event inspections are required to occur at the frequency specified by the permit following each measurable storm event equal to or greater than 1/2 inch of rainfall.

Contracts operating under waterway permits and without a CSGP, do not have a requirement for formal inspections. The waterway permits require the BMPs to be maintained at all times and repairs performed as required when deficiencies are discovered. The PEMS should conduct QA inspections.

Inspection reports are to be submitted by the Contractor’s designated Stormwater Quality Manager, SWQM, within 24 hours of the day of the inspection. The reports are to be documented and submitted electronically using the current version of the Department’s stormwater inspection process. A paper inspection form may be used in the event that the electronic inspection process is out of service or as directed.

The PEMS is responsible to verify that the Contractor’s SWQM has submitted inspection reports accurately, in a timely manner, and in accordance with the CSGP requirements. Any additional stormwater management features suggested by the Contractor’s SWQM in the inspection report should be evaluated and either accepted or denied and documented by the PEMS on the inspection report. Evaluations of any proposed new stormwater management features should include discussions with the AE, District Stormwater Specialist, the Designer, and the ES Stormwater Specialist. They can help determine and ensure that the contract continues to meet the intent of the Specifications, maintains economic value, and maintains compliance with all requirements of the CSGP.

As with any plan, it is not uncommon for changes to be made for the plan to work properly. Similarly, the stormwater management measures in the contract must be used to their best advantage to accomplish the job. Therefore, some stormwater management item quantities may overrun and some may underrun. The PEMS must use their best judgment and work with the Contractor, AE, the District Stormwater Specialist, the Designer, and the ES Stormwater Specialist to adapt the best plan to fit the actual conditions of each contract while still maintaining efficient use of BMPs. All of the initiated changes should be documented as amendments to the SWQCP.

The processes discussed within this section can be referenced within the Department's Construction Stormwater Management Field Guide.

3.1.5 Notice of Termination, NOT

An NOT must be obtained on any contract that requires a CSGP before the contract can be accepted and closed out. To successfully obtain an NOT, the CSGP requires 70% uniform density of permanent vegetation for turf areas. When using native seed, as required by waterway permits or the design of a stormwater measure, the NOT may be accepted with established vegetation levels less than 70% if the area does not pose a risk of offsite sedimentation. **Until the NOT is successfully obtained for these contracts, inspections are required to continue to be completed.** Answers to frequently asked questions are be covered in the remainder of this section:

- **What are the required procedures to obtain an NOT?**
  There are two different contract types that should be reviewed when deciding what is required to successfully obtain an NOT.

  - **INDOT Permitted Contracts** comprise the majority of Department contracts, including Design-Build but not including LPA contracts. For INDOT permitted contracts, follow the process described in **INDOT NOT Process** section below.

  - **Third-Party Permitted Contracts** include CSGPs that are submitted by the LPA's or Contractor's employee in responsible charge (ERC) who initially applied for the CSGP. For this type of contract, follow the process described in **Third-Party NOT Process** section below. The documentation of an LPA or **Contractor** NOT determination may be used for process reviews performed by the Department on those contracts as a means of QA for the process.

- **What is the NOT documentation process?**
  The documentation process is intended to provide a consistent and uniform

methodology to assess the condition of any particular contract site for NOT review. Guidance to assist with the process is available in ***Photographic Documentation Instructions*** section below.

- **What to do if the NOT is not obtained**?
  ES or the ERC will inform the PEMS if the project meets the requirements of 70% uniform density of permanent vegetation. If the project does not meet the requirements, the Contractor must stabilize the project and continue to perform stormwater maintenance along with inspections until the NOT is obtained. The Contractor should be paid additional costs for corrections if it is determined that all prior work was performed as required by the SS.

  - Additional costs will be reviewed for payment on a case-by-case basis. Additional costs may include, but are not **limited** to, document preparation on projects that go beyond the contract completion date due to the NOT, additional seeding or work needed for stormwater management items, etc.

  - For unhealthy vegetation **areas**, soil mitigation measures may be considered by the Department.

  - Costs and potential costs should be discussed with the AE, especially if the magnitude of the costs is estimated to be high. The Department may wish to consider additional options.

  - A time extension will not be required if obtaining the NOT causes contract time to overrun. It is the Department's intent that the time it takes to get the NOT after the original **completion** date be covered by a Final Inspection Time Waiver just as if you had added extra work to the contract at the final inspection.

- **What is the process to close-out a contract?**
  The following procedures provide information on documenting that the NOT has been obtained and completing the contract closeout process.

  - **INDOT Permitted Contracts:**
    ES will provide the PEMS a copy of the IDEM email submittal confirmation.

  - **Third-Party Permitted Contracts:**
    The ERC will provide the PEMS a copy of the IDEM sufficiency statement.

If the turf is green and looks healthy, contact ES or the ERC even if the density may not appear to be 70%.

3.1.5.1 INDOT NOT Process

Step 1:

- The Contractor and the PEMS will evaluate the project and agree that 70% uniform density of permanent vegetation has been obtained.
- All temporary stormwater Best Management Practices (BMPs) shall be removed prior to applying for the NOT.
- The PEMS will confirm and document the following:
    - All temporary stormwater BMPs have been removed
    - No further earth disturbing activities are planned for the project
    - All excess silt accumulations have been removed
    - All areas have been dressed
    - Vegetation has been re-established to all bare areas in accordance with the contract requirements
    - Both parties agree that the site meets the 70% uniform density of permanent vegetative coverage for turf areas.
- The PEMS will document actual site conditions by taking photographs as detailed in Photographic Documentation Instructions.

Step 2:

- The PEMS will notify ES of their desire to request the NOT with the following:
    - Email the request to the INDOT's Stormwater Team (csgp@indot.in.gov) and copying the appropriate persons involved with the contract (DCD, AE, INDOT PM, and District Stormwater Specialist).
    - Attach the documentation, listed in Step 1 above, to the email along with a written statement of agreement from the Contractor, and site photographs as described in ***Photographic Documentation Instructions*** section below. The Stormwater Team will determine if the site meets the requirements for NOT based on the provided documentation, site visits, and/or other sources.
- If documentation confirms that the site meets NOT requirements, ES will notify the PEMS of the determination of the NOT by providing the PEMS and all

appropriate persons involved with the contract (AE, DCD, INDOT PM, District Stormwater Specialist) with a copy of the IDEM email submittal confirmation.

- If documentation fails to confirm that the site meets NOT requirements, ES may schedule a field review with District Construction and the Contractor to discuss additional work that needs to be completed or considered. When any necessary work is completed, start back at the beginning of Step 1.

Step 3:

- The PEMS will attach a copy of the NOT submittal confirmation from IDEM into AWP.

  NOTES - At the end of the allowable time for a contract, District Construction will decide on how to proceed if documentation fails to confirm that the site meets the requirements for NOT. Normally, the Department will keep the contract open until the requirements of NOT are met. Site inspection reports and maintenance must continue until the requirements for NOT are met.

3.1.5.2 Third-Party NOT Process

Step 1:

- The ERC and PEMS will evaluate the project and agree that 70% uniform density of permanent vegetation has been obtained.

- All temporary stormwater Best Management Practices (BMPs) shall be removed prior to applying for the NOT.

- The PEMS will confirm and document the following:

  - All temporary stormwater BMPs have been removed

  - No further earth disturbing activities are planned for the project

  - All excess silt accumulations have been removed

  - All areas have been dressed

  - Vegetation has been re-established to all bare areas in accordance with the contract requirements

  - Both parties agree that the site meets the 70% uniform density of permanent vegetation coverage for turf areas.

- The PEMS will document actual site conditions by taking photographs as detailed in ***Photographic Documentation Instructions*** section below.

Step 2:

- The PEMS will notify the ERC of their desire to request the NOT with the following:
    - Email the request to the ERC, and copying the appropriate persons involved with the contract (DCD, AE, INDOT PM, District Stormwater Specialist).
    - Attach the documentation, listed in Step 1 above and site photographs as described in ***Photographic Documentation Instructions*** section below.
- If documentation confirms that the site meets the requirements for NOT, the ERC will prepare and submit the NOT form on IDEM's ePortal at the following URL https://stormwater.idem.in.gov/ncore/external/home
    - After NOT is deemed sufficient by IDEM, the ERC will notify the PEMS and all appropriate persons involved with the contract (DCD, AE, INDOT PM, District Stormwater Specialist) of the IDEM NOT sufficiency.
- If documentation fails to confirm that the site meets the requirements for NOT, the ERC may schedule a field review with District Construction and the Contractor to discuss work that needs to be completed or considered. When any necessary work is completed start back at the beginning of Step 1.

Step 3:

- The PEMS will attach a copy of the NOT sufficiency statement from IDEM into the AWP correspondence log.

  NOTES - At the end of the allowable time for a contract, District Construction will decide on how to proceed if documentation fails to confirm that the site meets the requirements for NOT. Normally, the Department will keep the contract open until the requirements of NOT are met. Site inspection reports and maintenance must continue until the requirements for NOT are met.

The documentation of an ERC's NOT determination may be used for process reviews performed by the Department on those contracts as a means of QA for the process.

3.1.5.3 Photographic Documentation Instructions

The site conditions will be documented as follows:

- Take at least one (1) panoramic photograph and four (4) perpendicular spot photographs, taken from chest height, at locations showing the most representative turf areas. These photos shall be taken in a digital format. They should provide characteristic information of the area. Additional panoramic and perpendicular photographs should be taken in areas of interest for stormwater protection such as at bridges, pipe inlets and outlets, and areas of steep or long slopes.

- Panoramic photographs of turf areas must be in focus and show as much of the vegetated areas as possible.

- Perpendicular spot photographs should be taken in a standing position with the camera at chest height directly above areas of the least vegetated turf. Showing the tips of your boots in the photo is acceptable.

The photographs for both the panoramic and perpendicular spot locations should be taken at a time of day that best minimizes shadows. This time normally occurs between 11 a.m. and 4 p.m. When taking panoramic photographs, ensure the general focus of the photo is on the turf areas offset from the road. Do not center the road in the picture as indicated in Image 1 of this appendix. Pick a time of day when a good representation of the area can be seen as indicated in Image 2.

ES, or the ERC, will base their determination on the information obtainable from the photographs taken. They will review the overall look of the turf, its health and coverage, and the general slope conditions in the area.

The photographs at the end of this section show variations in the percentage of vegetative density. An area density showing less growth but occurring on a flat area, with low potential for erosion, may be sufficient for NOT. However, if the same density is located on a steep slope with higher erosion potential it may be determined that the density is not acceptable.

A yellow color for vegetation may be viewed as being unhealthy and may require soil enrichment as indicated in Image 3.

Image 1: Example of both poor placement of the roadway within the picture and poor lighting conditions

Image 2: Example showing a good representation of the area

Image 3: Yellow vegetation may be viewed as unhealthy and may require soil enrichment

A series of pictures are shown below to provide examples of vegetation coverage percentages.

Image 4: Vegetation Coverage: 40-50%

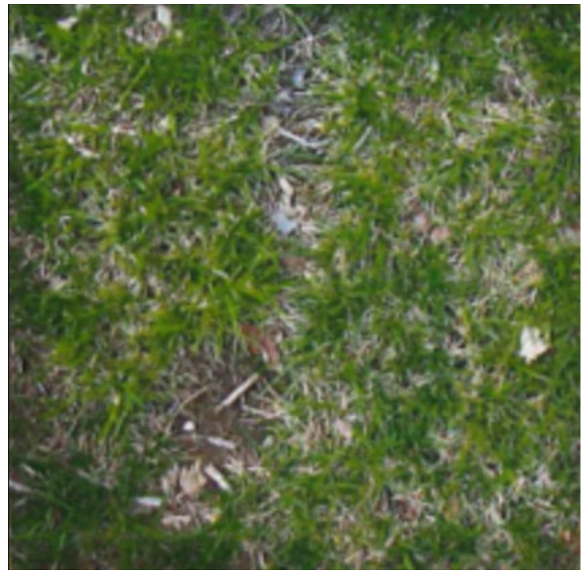


Image 5: Vegetation Coverage: 50-60%

Image 6: Vegetation Coverage: 60-70%

Image 7: Vegetation Coverage: 70-80%

3.2 POST-CONSTRUCTION STORMWATER MANAGEMENT *(add. 12-01-25)*

In accordance with an MS4 General Construction Permit and CSGP applicable to the contract, to implement permanent Post-Construction Best Management Practices, PCBMP, for the site, when required. The PCBMPs are detailed on the plans. These practices are necessary and required to comply with the above mentioned contract environmental permits and work to control erosion and sediment beyond the completion of the contract.

There are many devices and systems available for use as PCBMPs. These are described in greater detail within the SS.

Deviations from the planned implementation are required to be submitted for review to the PEMS and the Department's Post-Construction Stormwater Management team's email address, PCSM@indot.in.gov, at least 14 days prior to installation. A professional engineer must sign any revised design calculations made during the construction of the PCBMP.

3.3 BORROW AND DISPOSAL SITES

The Contractor must submit proposed borrow and disposal site locations to the PEMS for approval. Form IC-203, Request for Acceptance of Borrow or Disposal Site, is available on the Department's website and must be completed by the Contractor for each proposed site and submitted to the PEMS for approval. The form requires the Contractor's signature certifying that they have complied with all environmental laws and regulations required to perform the planned operations at the site. The PEMS will review and sign the form if it has been properly completed. A site must be approved before the Contractor can begin operations at the site.

Requirements for different types of sites shall be in accordance with 203.08 of the SS.

The primary need to review and approve borrow and disposal sites is to help prevent those sites from being developed in wetland areas or from disturbing archeologically sensitive sites. As the owner of the contract, the Department is responsible to take measures to prevent these occurrences.

There are many different situations that can arise when determining whether a borrow or disposal site is acceptable. However, the SS are intended to provide the PEMS the tools necessary to reasonably ensure that the Contractor has taken appropriate measures to prevent borrow or disposal operations from becoming a violation of environmental laws.

In some cases, such as existing commercial operations where the entire area has previously been developed, there can be consideration made as to whether the requirements for a wetlands delineation or archeological investigation are appropriate. There are areas on form IC-203 for the Contractor to explain why certain permit requirements may not apply to a given situation.

The PEMS must use the SS and their best judgment to reasonably determine when a given area may or may not require all environmental work to be done. However, it is the Contractor who is ultimately responsible for ensuring compliance with the laws. By contract, the Department's approval of borrow or disposal sites **does not** relieve the Contractor of any obligations or penalties under the law. The Department will hold the Contractor responsible, not the PEMS, if a borrow or disposal site turns out to be in non-compliance with any law or regulation. It is not the intent of the Department's procedures to place the PEMS in a position of responsibility for the Contractor's compliance requirements with the laws, but rather to provide a means for the PEMS and the Department to be aware of the Contractor's planned sites and to obtain the Contractor's certification that they comply with the laws. If the PEMS has questions about a given site, they should contact the AE for further guidance.

3.4 GENERAL *(rev. 12-01-25)*

Unless advised to the contrary, no restrictions should be placed on the Contractor by the PEMS as to where the Contractor shall commence work, except that where the alignment follows an old road, the road must not be in disrepair during the winter months.

A Contractor must not be allowed to construct earth cofferdams, earth causeways or other earthen structures in a stream without a regulatory agency permit. This is a violation of environmental law. For non-earthen cofferdam and causeways, the Contractor is required to submit detailed design to the PEMS as part of the SWQCP or approved site plan, developed by the Contractor, for acceptance. If the cofferdam or causeway is not included in the permits obtained by the Department for the contract, the Contractor must submit a permit modification request to PEMS prior to starting the work. The request must include:

- The scope of the proposed changes to the permit
- The reason for the additional impacts and any avoidance or minimization that has been considered
- Contract plans marked with the locations of all proposed changes.

Accepted modification requests will be forwarded to the appropriate regulatory agency by the Department's Office of Ecology, Waterway Permits, and Stormwater.

Work on the revised causeway details is not to progress until the approved permit modification request has been received and posted at the worksite.

Construction of drainage facilities and performance of other contract work which will contribute to the control of stormwater must be carried out prior to, or in conjunction with any land-disturbing activity. The Contractor may be required to construct temporary berms, dikes, slope drains, or sedimentation basins to prevent sedimentation before the permanent stormwater features are placed.

To help prevent erosion, sodding and seeding of cut and fill slopes should be accomplished as construction progresses instead of waiting until the end of a construction season. Temporary seeding should be required when areas of disturbed earth will be open for more than 7 days or as agreed to by the Contractor and the Engineer. The Contractor should manage earth disturbing activities such that temporary and permanent seeding or sodding can occur prior to the end of the growing season to prevent winter long stormwater management problems.

As provided in the SS, the Contractor is responsible for the repair and restoration of any damaged sodded and seeded areas prior to final acceptance. This includes work necessary to comply with the requirements of stormwater management.

The procurement of soil samples, representative of the soil to be incorporated in embankments, should be one of the first activities of the PEMS. The sample submittals must be discussed with the District Testing Engineer as soon as possible in order to expedite the return of the results to the PEMS. This data obtained from the samples is necessary to perform proper density tests. The samples must be appropriately tagged and identified for correct results to be returned.

3.5 STAKING AND CONSTRUCTION ENGINEERING

Staking is performed almost exclusively by the Contractor and paid under the items and specifications for construction engineering. The following instructions apply only in cases where construction engineering by the Contractor is not included in the contract or if it is determined that additional staking is required and it will not be added to the contract by change order.

When staking is performed as part of a construction engineering pay item, the Contractor will frequently use GPS, surveying equipment to establish and control grades on the contract. This “stakeless” surveying does not lend itself to checking of grades by the PEMS. However, it should be noted that the SS require the Contractor to furnish all staking necessary for checking of the work. This is a topic that should be discussed with the Contractor at the pre-construction conference.

If the contract does not have a pay item for construction engineering, the PEMS should determine, as soon as possible, at what point the Contractor intends to begin work and start setting grade stakes. The rough grade stakes should be set for the embankment balance of the contract as rapidly as possible. This procedure will expedite the moving of utilities and fences which quite often causes delays in grading operations.

Rough grade stakes should be of appropriate length and type to serve the intended purpose and last for the duration of the work. They should be planed on two sides to facilitate marking. They should be set on each side of the road on the ROW line, at each station, at 50 ft intervals on all horizontal curves over four (4) degrees, and on all vertical curves where the algebraic difference of gradients is greater than six (6) degrees. Normally, grade stakes set on the ROW line serve to denote the limits of the ROW. Therefore, a stake should be set at any break in the ROW to facilitate the erection of fences and relocating of utilities. If Department personnel have set the grade stakes, the Contractor should not be allowed to remove rough grade stakes unless approved by the PEMS. Negligence in preserving grading stakes should not be tolerated.

Before and after setting the stakes, the plans and cross-sections should be carefully examined to make sure that sufficient ROW has been shown on the plans. Particular attention should be given to special ditches, relocation of streams and ends of structures in narrow channels. Stakes should be driven at least 1 ft into the ground and station number and offset distance marked on them. In some locations, it is advantageous to set the rough grade stakes flush with the ground and place guard laths with station and offset distance. Elevations should be taken on the top of the stake and the ground at centerline so that grade sheets can be prepared. Grade sheets indicate the vertical distance from the top of the grade stake to a specific plan grade at centerline. This specific plan grade may be the finish grade on regraded sections, the top of subgrade, or the top of a base or surface course. However, the grade used must be noted somewhere on the sheet.

Any change in grade or any correction made after issuing the grade sheet should be shown on a revised grade sheet with the corrections or revisions noted. Taking elevations of all grade stakes should START FROM A BENCHMARK AND TIE INTO A BENCHMARK EACH TIME ELEVATIONS ARE RUN. Rod readings on hard surfaces such as PCCP, HMA, concrete curbs, benchmarks, etc. are read to hundredth of a foot (.01). All notes must be recorded and kept in the contract files.

Upon assignment to a project, the setting stakes should be pursued until the entire contract is staked. If the stakes are set during the winter months, elevations should not be taken on them until the Contractor is preparing to begin grading or until the frost has left the ground. Stakes set in the winter should be driven lightly again before taking elevations. Elevations taken on stakes in the winter months must be rechecked in the spring.

Since the construction work may disturb stake alignment, horizontal control points such as a Point on Tangent, P.O.T., Point of Curvature, P.C., Point of Tangency, P.T., etc. must be referenced to stakes or objects that will not be disturbed. There are a number of methods used in referencing points. Consideration should be given to the availability of the reference objects after the grade has been completed. All references must be recorded within the permanent field notes and kept in the contract files.

3.6 CHECKING ORIGINAL CROSS SECTIONS

When there is a pay item for construction engineering in the contract, the Contractor must take complete cross sections at 500 foot intervals and verify that the planned alignment and grades will match the existing conditions.

If an item for construction engineering does not exist, then the PEMS must make the cross section checks. The PEMS may elect to discuss the situation with the AE and establish an item for construction engineering for the contract through a change order.

While setting rough grade stakes, the elevation of the original ground at the centerline of each station must be recorded. A complete cross section must be taken every 500 foot. The centerline elevation at each station and the cross sections must be checked with those on the plans. If they do not check satisfactorily, or consistently vary more than 0.2 ft from the original sections, the reason should be found and the investigation continued to determine the correct original cross sections. It may be necessary to cross section the project again. In case of doubt, consult the AE.

3.7 SLOPE STAKES

This work is typically required to be performed by the Contractor as part of the construction engineering pay item. If a pay item is not included in the contract, the PEMS must perform the staking required. The PEMS may elect to discuss the situation with the AE and establish an item for construction engineering for the contract through a change order.

Slope stakes should be set at each station for both cuts and fills throughout the entire length of the contract including additional slope stakes for special ditches. The distances from the centerline to the slope stakes shall be shown on the grade sheets with the slope shown in the "Cross Section" column. In preparing to set slope stakes, the cross sections should be studied to note planned variations from the typical cross section and slopes.

The slope stake field book should contain notes as to cut or fill, distance from centerline and elevation at which the slope stake was set. The elevation at which the slope stake was set is useful in tying final cross sections and in plotting the slope stakes on the original cross section sheets.

When rock is encountered in a cut with an overburden of earth above it, the cut shall be made by excavating the earth far enough back so that a shoulder or shelf will be left on top of the rock between the base of the earth cut and the top of the rock cut.

In cuts where it is not known, or cannot be determined with certainty, how far the rock is below the surface of the ground, the slope stake shall be set as if the entire cut consisted of earth. The overburden would then be excavated on the normal earth slope to the top of the rock. After the overburden has been stripped from the rock, the top of rock is slope staked for the typical rock section or to slopes designated by the PEMS. A separate or supplemental grade sheet for this slope staking work should then be completed. The distance to the top of the rock slope and designating the cross section to be constructed should be shown. Where rock cuts are very short, construct the typical earth cross section.

3.8 CLEARING ROW

Upon assignment to a contract, the PEMS should request copies of the ROW grants from the DO and compare the ROW distances on the grants with those on the plans. The DO should be notified of any discrepancies that are discovered. All buildings, gasoline pumps, etc. shall be removed from the ROW. A time limit for the removal of buildings from the ROW is usually incorporated in the ROW grant. If there is difficulty in getting them removed, the matter should be taken up with the DO. It is easier to remove all encroachments at this early stage of construction rather than just prior to final acceptance.

ROW grants must be checked for special commitments. When shown, these commitments must be fulfilled. ROW commitments may be fulfilled within the existing or future contracts, or the property owner may have been compensated during contract development. For these reasons, the PEMS should not promise or commit to perform work or other tasks for property owners that would directly profit the property owner. The exception to this policy would be when tasks are already shown on the plans. Where commitments are noted in the parcel files and not included in the contract, the PEMS should notify the PM and the AE to help with verification.

Vegetation and trees between the construction limits and the ROW line must be preserved as much as possible. The waterway permits for the contract often do not cover work outside of the construction limits. The PEMS must be aware of the limits covered by the permits before allowing any clearing outside of the construction limits. Before the Contractor starts clearing the ROW, all trees to be removed should be marked. Occasionally, ROW grants contain provisions for leaving specific trees on the ROW. These trees must not be disturbed. The Contractor should be notified of the exceptions. The PEMS should be advised of any proposed tree trimming by utilities.

Before trees, stumps, rubbish, or other material can be deposited beyond the ROW limits by the

Contractor, they are required to submit a waste disposal plan as provided in the SS. After the contract has been completed, the Contractor should obtain signed property releases (Form IC-149) for the disposal areas, borrow pits, plant sites, etc. A copy of these releases must be included in the contract file.

On pre-graded projects, the paving contractor is required to mow weeds and clean up the ROW, without compensation, in the same manner as on a grading or a grading and paving project.

3.8.1 Temporary ROW for Private Drives

All ROW matters, except temporary ROW for private drive extensions, will be handled by authorized ROW agents. Where additional ROW is necessary for planned construction, constructing outlet channels, peat disposal, authorized grade changes, etc., sketches of the additional ROW with the property owner's names should be made and submitted to the DO for acquisition.

3.8.2 Temporary ROW for Building Removal

Many of the road and bridge plans indicate TEMPORARY RIGHT-OF-WAY FOR BUILDING REMOVAL. In numerous instances the property owner cannot utilize the remainder of his property until the building has been removed and the temporary ROW formally released by the Department. In some instances the courts have been critical of the delay in making the temporary ROW available to the owner. In view of the above, the Real Estate Division has requested that their office be promptly notified when the building or buildings, on any individual tract or parcel of temporary ROW that was acquired for building removal purposes, have been removed. The Division of Construction Management should be advised when such temporary ROW may be formally released to the property owner. Construction Management will in turn inform the Real Estate Division. It is suggested the removal of buildings located on temporary ROW be considered at the pre-construction conference or early in the life of the contract. Every reasonable effort should be made to expedite the removal of those that fall outside the permanent ROW. Conducting business in this manner will contribute to a more favorable public opinion of the contract and the Department.

3.8.3 Sign Encroachments

The owners of outdoor advertising signs located within the ROW should be advised, either by personal contact or by letter, to remove their sign. If the sign is of material value and the owner does not desire to salvage or relocate it, a letter should be secured from the owner so indicating. Once the letter is received, the Contractor can then proceed to remove the sign in accordance with the provisions of the SS. If the sign is of material value and the owner refuses to remove the sign, the DO must be contacted for guidance.

3.8.4 Archeological Artifacts and Historic Features

If archeological artifacts or historic features are found, work must be stopped immediately in the area of the discovery. Section 3.22 of these instructions provides guidance on how to proceed.

3.8.5 Disposal of Timber

The following procedures apply to the disposition of merchantable timber within the construction limits:

(1) Section 201.03 of the SS provides that "All merchantable timber in the clearing area, which has not been removed from the right-of-way prior to the beginning of construction, shall become the property of the Contractor, unless otherwise provided." This will be the procedure in most cases.

(2) In the event the Real Estate section has arranged with the property owner, as a part of the ROW settlement, for the property owner to retain and remove the timber, this information will be included in the contract special provisions.

3.9 CUTS

The typical sections will indicate the normal slopes based on the minimum ROW and width of roadway. A different typical section will be used for rock cuts than that used for earth slopes. The cross section sheets should be checked for exceptions to the normal slopes. Terrain or soil conditions may also necessitate deviation from the typical slopes. Flat slopes provide additional safety, can reduce erosion, are easily maintained, and greatly improve the appearance of the road by blending in with the adjacent topography. In deep cuts, interceptor ditches should be cut at the top of slopes when the width of the ROW permits.

It is standard practice to flare side ditches at the end of cuts to avoid spilling side ditch drainage onto a fill slope. The additional excavation required for flaring ditches is authorized excavation, and slope stakes should be set accordingly.

Special ditches shall be located as close to the ROW lines as possible to minimize the hazard of deep ditches located near the shoulder line. Special ditches should be constructed to provide a smooth alignment but not necessarily constructed parallel to the centerline. The flow lines of special ditches with flat gradients should be staked for final finishing.

Where dirt is left in place for shoulders, transverse trenches shall be cut through the shoulders at sufficient intervals to maintain the subgrade in a well drained condition. The center of the roadway shall also be crowned to provide drainage. Cuts should be excavated so that water will not pond at the face of the cut. Dirt for shoulders shall not be left so high as to interfere with surfacing or finishing operations. The use of slope drains and directional interceptors for moving surface water across the earth shoulders helps to minimize both erosion and potential re-work of the slopes due to run-off.

Where backslopes for cut sections are made in material which is not suitable for the growth of vegetation, the PEMS can authorize the undercutting of such slopes and the backfilling of the same with suitable material for encasement, in accordance with 203.09 of the SS.

No trees outside the slope-stake limits are to be disturbed, damaged, or trimmed unless authorized by the PEMS.

Instructions pertaining to the grading of approaches are included in Section 18 of these instructions.

3.10 EARTH CLASSIFICATION

The different classes of excavation are outlined in the SS. It is imperative that all classes of excavation be measured in their original position and an accurate set of notes kept which indicate the quantities of each class of excavation. Original cross sections for rock excavation are taken after the overburden is removed. Original sections are taken for each section within the plans plus any necessary supplementary sections. Check shots for minimum depths below pavement are made after the rock is removed and before the cut is backfilled.

It is important that the field notes be complete with title, closed bench circuit and dates. The time for this work to be performed, including any necessary explanatory notes, is when the work is being performed.

A copy of the Soil Report and Soil Profile should be retained by the PEMS for information and guidance during construction of the contract. The copy should be kept in the contract field office.

3.11 EMBANKMENTS

The SS state that after embankment areas have been cleared of all perishable materials such as trees, stumps, sod, weeds, cornstalks, etc., the upper 6 in. of the natural ground shall be well compacted with approved compaction equipment. Dirt stockpiles from structure excavations should be removed and if suitable, incorporated in the embankment in layers. Weeds and brush should not be placed in the toe of slope. Sound stumps and non-perishable solid objects may be left a minimum of 3 ft below subgrade or slope of embankments provided they are nearly flush as possible, but they must not extend more than 4 in. above the ground line or low water level. Sound stumps may be cut off at ground level outside of the toe of the slope.

Earth embankments must be constructed in layers of the thickness specified, leveled, disked, and thoroughly compacted. When using a three wheeled 10 t roller or pneumatic tired roller, the layer must not exceed 8 in. before compacting. When using a sheepsfoot roller, the depth of the loose dirt must not exceed the length of the tamper feet. If the material is of a granular nature, a heavy crawler type tractor may be used, but the depth of the layer must not exceed 6 in. For areas inaccessible to the above equipment, such as structure backfills, the material must be placed in 6 in. layers and compacted with mechanical tamps or vibrators. To maintain these maximum depths of lifts, it is essential that each embankment lift be leveled, preferably by a grader. It is nearly impossible to achieve uniform compaction unless the fill lift is reasonably level and uniform.

Recycled asphalt pavement, RAP, and recycled concrete pavement may be used within embankments when they meet the requirements of the SS. RAP intended to be incorporated into embankments must meet particle size requirements, in accordance with the SS, prior to being placed into embankments. Likewise, recycled concrete pavement, defined as concrete pavements from past documented Department contracts, shall meet the SS requirements of B borrow prior to being placed into embankments.

Different sized materials shall not be mixed or mixed with other materials when used for embankments. When two or more approved materials are allowed for one embankment, those materials shall be separated with a layer of geotextile, in accordance with the SS.

RAP and recycled concrete pavement should not be used for embankment construction when certain subgrade treatments are to be used, unless approved by GS. These specific subgrade treatments are described within the SS. Geotextile shall be placed completely covering the top of embankment areas containing recycled materials. In addition, a minimum soil encasement shall be constructed concurrently with the recycled material lifts.

The base of fills shall be constructed to the full width between slope stakes. On high fills the width should be checked periodically as the fill progresses. Side casting to bring the fill to the proper section should be avoided since side casting usually develops a fill slough or slide.

After clearing of the embankment area and prior to embankment placement, all pronounced depressions left in the original ground shall be filled with suitable material and compacted. Proofrolling of the natural ground surface shall be performed in accordance with the SS within all areas where new fill is to be placed. Original ground that cannot be compacted sufficiently shall either be replaced or dried with a soil modifier.

The grading should be watched closely for unsuitable material. Roots should be removed and disposed of properly. Frozen material must not be used in the fill and a lift of dirt must not be placed upon a frozen layer. The frozen layer may be removed or bladed over the side of the fill.

As noted in the SS, rock lifts or layers are variable in height depending on the amount of rock, topography, type of rock, and mixtures of soil and rock. There should be a minimum of voids in rock fills. Bridging by slabs of rock should be avoided by judicious use of a bulldozer.

When aggregate is used for embankment construction and it is not possible to perform stiffness or strength testing, the material should be compacted with several passes of crawler-tread equipment, or with vibratory equipment, or both. Equipment weight shall be at least 10 tons. The PEMS may want to consult with the AE prior to making this determination.

For LWD testing of aggregate, if average deflection for the aggregate is greater than the maximum allowed deflection in accordance with the SS, a sample of the aggregate should be obtained and a moisture content test performed to determine if the aggregate moisture content is within acceptable limits. If the moisture content is outside acceptable limits, wait 24 hours, retest for acceptable moisture content, and test the aggregate at the same location. The aggregate test will be acceptable if the LWD tests are equal to or less than the allowable average deflection. Questions on sampling and testing procedures can be directed to the DMTE.

The critical point of any grade is the junction of the cut and the fill. If not properly constructed, a weak spot in the finished grade will result. In many cases, especially where there is a quantity of topsoil, it is advisable to undercut the beginning or ending of a fill into the cut and replace with suitable material.

Attention must be given to methods of building embankments on steep side hill slopes as outlined in the SS. Plowing is not a pay item, but benching may be paid for at the classification encountered. In general, benching should be considered if the slope is steeper than 4:1.

Where an existing fill will not accommodate the full width of the new pavement, the existing fill shall be excavated and the material, if suitable, used in the new embankment. This work is authorized excavation. The handling of embankments over existing pavement is explicit within the SS.

Broken concrete or brick pavement may be disposed of in fills at least 24 in. below subgrade elevation. They must be spread in such a manner to fill the voids with soil and the layers thoroughly rolled.

Embankments around the end bents of bridges must be constructed at the same time and in the same manner as the approach fills and before end bent piles are driven. Intermediate bents or piers which fall within the toe of the approach fill must be back-filled to the original ground line with B borrow. The fill above the original ground line at these bents shall be kept balanced on both sides of the bent and carefully compacted. Care should be exercised to prevent displacement of the piers or bents. Density and moisture tests must be performed and documented as required.

Compaction tests are based on dry weights. The moisture content must be controlled as per the SS or as recommended by GS. In actual practice, excessive moisture in the soil is obvious. A practical solution is to disc and aerate the lift of earth until it has dried sufficiently to compact satisfactorily. Soils that are too dry to compact to the minimum density can be disked, wetted and re-compacted. However, it is the Contractor’s responsibility to determine the methods to obtain the proper moisture content of the soil.

The SS provide for aeration of embankment material if the material is too wet and the embankment is not satisfactory. This moisture provision was adopted to protect the Department from having to accept fills that passed the density specification but were obviously unsatisfactory as evidenced by excessive rutting under the construction equipment. The aeration provision is to be used when the embankment is not satisfactory but not to be used merely because the material is over optimum moisture. The Contractor must keep the grade properly drained. If necessary, payment should be withheld on grade work not properly drained.

The SS state that if embankment material is too wet or too dry, the material should be aerated to remove excess moisture or watered and disked to increase the moisture content until the moisture content is within the appropriate range. The determination of whether a fill is satisfactory involves analysis of the required density and moisture tests as well as personal judgement. Some degree of deformation of the fill under the heavily loaded equipment can be tolerated providing the fill is dense, well compacted, and not developing permanent ruts.

The definition of excessive permanent rutting involves personal judgment. As a general guide as much as 3 in. of rutting could be tolerated under the modern, large capacity, heavily loaded equipment and still may not be detrimental, providing the fill meets density and moisture requirements. This general guidance for depth is relative to the original top of fill. Equipment should not be allowed to “follow the leader” in the same track. This type of “follow the leader” process can aid in pumping water into the surface layers or pulverize soil cohesion and ruin an otherwise acceptable fill.

QC/QA procedures for construction of fill and subgrade sections involve the use of the DCP. The Contractor is required to provide a QCP describing the operations. This plan is subject to review and approval by the PEMS. The Contractor will receive written notification of plan approval before soil and subgrade operations begin.

QC testing is required to be performed by the Contractor in accordance with ITM 803. The Contractor is required to provide documentation by the end of the following business day or before the next QA test, whichever comes first. Test sections are required to be constructed in accordance with the QCP. Test sections for non-chemically treated soils should utilize procedures described in ITM 513 and ITM 803. Intelligent compaction methods, described within ITM 513, may be utilized but are not required. Acceptance of the soils should be as per the SS. Deficient areas found are to be reworked by the Contractor in accordance with the QCP.

3.12 GRADING OVER PEAT MARSHES

Every attempt is made during the design phase to locate all peat marshes. Soils surveys normally make investigations regarding types of soil and sub-grade conditions. Findings and recommendations are compiled from these recommendations. The soil information is normally incorporated into the plans.

The PEMS should review the soil report to help assure that its recommendations are incorporated into the plans.

Unless otherwise instructed, peat should be excavated and treated in accordance with the methods set out in the SS. The width of the excavation should extend to the limits shown on the typical sections, as determined by the depth, and to the bottom of the peat bed or firm foundation. If the bottom of the peat slopes transversely, consideration should be given to excavating to a greater width on the deepest side to minimize subsequent lateral displacement and settlement. In cases of transverse slopes on the bottom or when questionable material is encountered, the PEMS should contact the AE.

Cross sections must be taken before the peat is excavated and again before the backfill is placed, as outlined in 203 of the SS.

3.13 MEASUREMENT OF PEAT EXCAVATION

The contract should provide for payment of peat excavation. The typical sections included in the plans for peat excavation should show the limits of excavation, backfill, and disposal. The embankment is to be built with a 2:1 slope from the shoulder point of the roadway down to the original ground line with compacted soil. From that point on the OG, a 1:1 slope should be constructed down to the lowest elevation of peat excavation. This established point determines the lower limit of peat excavation. The pay quantities for peat excavation will be limited to the volume of peat lying between the vertical neat lines for peat excavation from the lower limits to the OG. B borrow should be placed in the excavation left by the peat removal and paid for as shown in the contract.

Peat may be placed in the side slopes of the embankment outside the 2:1 slope shown on the typical section to the finished side slope. Peat may also be placed and graded to drain outside the backslope of side ditches to the construction limits. Also, temporary ROW for peat disposal will typically be shown on the plans.

When peat is removed by complete excavation, the volume will be computed from final cross sections taken after complete excavation and before placing granular backfill. Normal cross section methods and field notes should be used.

When peat removal by displacement is necessary, the volume will be computed from final cross sections derived from test holes through the completed granular treatment. A bid item for Cased Test Holes will be included in the contract for this purpose, unless otherwise specified in the CIB. An external pipe, of a diameter chosen by the Contractor, will provide the outside casing. Water pumped through a smaller diameter inner pipe will facilitate sinking of the casing and determination of the depth. Color of the wash water and material rising to the top indicates the change in material at the bottom of the casing. Therefore, the Contractor should arrange the two pipes and water pressure such that the wash water rises between the pipes rather than outside of the larger pipe.

A record of the cased test holes must be kept. Cross sections from test holes should generally be taken at stations 50 ft apart, or more frequent if necessary, and with a minimum of five test holes per cross section. The maximum spacing of test holes for cross section purposes should be 50 ft. A line of stakes should be placed on centerline and at the right and left edges of the treatment. All stakes should be graded to the same elevation, if possible. The HT can determine the elevation of the top of the B borrow by stretching a string across the three hubs and measuring down to the B borrow. As the HT observes the borings, the depth of penetration into the B borrow and trapped peat, if any, will be recorded. If there is any trapped peat, the pay length of the boring would be the sum of the depth of B borrow and trapped peat.

3.14 SLIDES

One cause of slides is free water. When free water is introduced into a cut bank or embankment in a quantity sufficient to reduce the angle of repose to less than the angle of cut or fill slope, a flow of soil or a slide occurs. Slides also occur when the surface of an impervious stratum is tilted to such an angle that it will not offer sufficient resistance or friction to withstand the weight or pressure of the overlying material. Another type of slide or slough that occurs in fill sections is caused by not rolling to the edges of each lift or by side casting material to bring the slopes to the proper cross section. Benching of hillside fills in potential slide areas should be discussed with the AE.

The PEMS should make a review of cuts where the natural slope of a hillside has been intercepted by a steeper slope. The presence of terraces adjacent to the project indicates former slides. If this equilibrium is disturbed, further sliding can be anticipated. Usually, the first indication of a slide in a complete or incomplete cut section is a bulging of the backslope with cracks parallel to the roadway appearing in the original ground on top of the backslope. It is at this stage the sliding plane, if any, can be observed. The PEMS should note this sliding plane by elevations and distances as an aid in determining the correction plan.

When slides are observed or encountered during construction, the PEMS will contact the AE and GS. Any field information obtained or observed concerning the slide must be discussed with GS to fully disclose the slide's conditions. The Department will provide remedial measures to address the associated slope issues. There may be a delay in operations until measures can be developed to address the situation. For additional information, reference 203 of the SS.

3.15 EXCAVATION FOR SMALL STRUCTURES AND CHANNEL CHANGES

No payment is made for any class of excavation necessary to construct pipe, box, or slab top structures, or miscellaneous structures which are less than or equal to 20 ft in span length. The exception would occur when the structure is relocated from the planned location or when the flow line lowered. Notice that this refers to additional excavation and is usually determined by cross sectioning the planned site and the relocated site. Established neat lines from the plans are to be used in this comparison.

Unsuitable material, which is authorized to be excavated below the planned elevation of the bottom of footings of the structure, is treated the same as above. When the undesirable material is removed in conjunction with adjacent excavation below grade, the entire volume shall be paid for at the contract unit price for the classification encountered and not considered as additional structure excavation. If selected material is used to backfill the excavated area, this material shall be paid for at the contract unit price for the material selected. No payment is to be made for material excavated below grade and backfilled for the convenience of the Contractor in stabilizing a normally stable foundation.

No payment is made for excavation within the ROW limits to construct a new or old channel to the grade and width shown on the plans or to the width of the new structure. Before starting channel change excavation that is a pay quantity, the cross sections should be checked for adequate coverage of the area and if necessary, additional sections taken.

3.16 SINKHOLES

Sinkholes occur in limestone areas present within the state and are the result of surface drainage through a hole or crevice in the top of the rock, a flow of water on top of the rock, or drainage through narrow horizontal seams. The surface of the ground often appears as saucer shaped depressions that vary in size from a few feet to possibly 400 ft in diameter. The actual fault in the rock may be directly, to as much as 35 ft, below the bottom of the depression. The opening may be exposed or it may not be visibly apparent. All sinkhole features are to be protected from sedimentation runoff in accordance with 205 of the SS.

Sinkholes are environmentally sensitive features and each must be addressed as a separate issue. If a sinkhole is discovered that is not shown on the plans, or if the excavation, capping, and backfilling of a sinkhole is not directly addressed by the contract documents, the PEMS must contact the AE, ES, and GS. Work within a 100 ft radius must be stopped. The PEMS should suspend work in this area per 104.02(b) of the SS. The Department will provide the treatment measures to address the feature.

When excavation, capping, and backfilling of a sinkhole identified within the plan documents, the following procedures should be utilized.

- Before starting the excavation of a sinkhole, original sections must be taken of the sinkhole site. If the hole or crevice is not exposed, it is suggested that the original sections cover an area beyond ROW to ROW and a comparable distance from the sinkhole ahead and back on centerline.

- The fault or crevice in the rock strata may be quite some distance laterally from the opening in the soil overburden. The additional area covered by the cross sections should anticipate this lateral drift or provide for a long crevice.

- When the opening in the rock is exposed, the dirt overburden adjacent to the hole should be excavated and the rock prepared for the cap. If the rock is not exposed and an opening occurs in the overburden, the opening must be followed to the rock.

- When a sinkhole with no apparent opening is encountered, the low point must first be determined by observing the area after a rain, leveling, or by observing the location of heavy vegetation. Using a scraper type of grading equipment, light parallel cuts need to be made through the area.

- This will usually disclose a small area of soil that is darker than the surrounding soils and/or an accumulation of small stones. The dark soil and stones should be followed with shovel or crane type of equipment to the top of rock. If the Contractor elects to use scraper type equipment after the initial cut, neat lines of excavation must be established, and the Contractor notified. As excavation proceeds, authorized neat lines of excavation must be documented.

- When the opening in the rock is revealed, the dirt is cleared for a distance of 2 ft to 3 ft on each side of the opening. It is often necessary to remove rock adjacent to the opening to obtain a satisfactory seal. The immediate area should be checked for secondary openings. The cap is then laid out to have a bearing of approximately 2 ft to 3 ft on the adjacent rock. It is unnecessary for the cap to be in the form of a square or rectangle, as may be indicated on the plans. The cap should conform to the figure required to cover and seal the opening. If the opening is a crevice, the cap shall extend a sufficient distance to provide adequate protection to the road, as determined in the field after consultation with the AE.

- Immediately after the cap is formed, or no later than the morning after the cap is placed, it shall be measured, drawn, and the area computed. Final cross sections are then taken of the entire excavated area, but payment is made only to neat lines previously established or authorized.

- As soon as a flexural strength of 480 psi is obtained for the concrete cap, based on beam breaks, consideration is given to the method of backfilling. When the cap is below the top of rock or a drainage cap is designed, B borrow should be limited and its use discussed with the AE, DCD, and the DMTE. When the excavated area is within the roadway area, ramps should be excavated parallel to centerline to eliminate abrupt changes in fill depth. A 3:1 slope is recommended for the ramping. Since ramping is paid for at the contract unit price for the class of excavation encountered and sinkhole excavation at 3 times the contract unit price for the classification encountered, the cross sections must clearly indicate this separation. No payment is made for backfill except for authorized B borrow. The backfill must be placed in accordance with the specifications and thoroughly compacted.

3.17 BORROW

Borrow is acceptable fill material obtained by the Contractor from locations outside of the ROW and used to complete the planned grading section. Coal ash as well as granular tire shed (GTS) mixtures may be utilized as borrow if they meet the requirements of the SS.

When coal ash is used as borrow, the Contractor is required to place the material in the embankment, compact, and encase the material as incorporated into the contract. If the material is stockpiled, it must be stockpiled at an approved location and in an approved manner. All control measures used should be included in the Contractor's submitted SWQCP, in accordance with 205. If there is no SWQCP required for the contract, control measures should be documented by the Contractor in the site plan and in accordance with 108.04.

Coal ash should not be mixed with other embankment materials within a given lift and should not be considered for placement in the following locations:

1. below existing ground,
2. within a 100 ft horizontal distance of a stream, river, lake, reservoir, wetland, karst feature, or any protected environmental area,
3. within a 150 ft horizontal distance of a well, spring, pond, or other ground source of water,
4. within MSE wall backfill,

5. as encasement material,
6. within the limits of subgrade treatment, and
7. directly in contact with any permanent metallic construction materials.

Compaction procedures and moisture content will be in accordance with 203.23.1.

Material such as muck, cinders, or a soil mixture with a high organic content shall not be used as borrow. Should the material be questionable, the AE must be consulted.

When borrow is necessary, the Contractor must make the arrangements for obtaining the material. The PEMS must be notified of the location of the proposed borrow pit and an IC 203 must be submitted for approval of the location prior to beginning land-disturbing activities.

If the location, planned excavation, and material comply with the SS, the Contractor may proceed with clearing the borrow pit site. Soil samples of the pit are then taken and forwarded to DMT. Before any pay material is removed from the borrow pit, the PEMS must establish a base line and take original cross sections for the pit. The base line should be established through or near the proposed borrow pit with the extremities of the line staked and referenced outside of the area that will be excavated.

Precautions are to be taken to ensure that the stakes or references are not disturbed. In establishing a base line, consideration should be given to the topography, the line of the cross sections, and the possibility of extending sections, if necessary. If the borrow pit involves a large area, it is suggested that an auxiliary line be run parallel to the base line to properly align the cross sections.

Borrow pits that are adjacent to the ROW often involve excavation within the ROW. No material excavated within the ROW is considered as borrow. If the borrow pit is in close proximity to the project ROW, a benchmark should be established near the borrow pit and the elevation of it tied into the project level circuit.

A rod reading and distance from the base line at the point each cross section intercepts the ROW line must be taken and noted. This will aid in computing the separation of the borrow quantity from the Common Excavation item quantity. A drawing must be made of the borrow pit layout in the permanent field notes immediately preceding the original cross section notes. A description of the location of the borrow pit must also be included with the drawing, including the offset, right or left, of a roadway station. The name of the property owner is also included with the drawing.

The SS must be read carefully relative to the location of borrow pits. Proximity to the ROW, elevation, drainage, erosion control, etc. must be evaluated.

Since the Contractor selects the source of borrow material, they are responsible for compliance with all environmental regulations that may govern the borrow site. The PEMS must evaluate the submitted IC 203 to determine if the Contractor has complied with the requirements of the SS.

3.18 B BORROW

B borrow consists of suitable crushed stone, sand, gravel, or other materials meeting the requirements of 904 of the SS. This material is used for constructing fills over peat marshes, as backfill for certain structures, or for other situations where settlement might seriously affect the finished work. B borrow should not be used for locations other than indicated on the plans, unless approved by the AE. Hydraulic methods of embankments construction, or for other instances, B borrow consisting of ACBF or GBF shall not be used within 2 ft of an embankment free water level.

The preferred method of placing B borrow is in specified lifts and then compacting that lift after placement. At locations that are inaccessible to heavy compacting equipment such as tractors, rollers, etc., vibrators or mechanical tamps are to be used. B borrow should not be used indiscriminately. Factors to be considered in choosing locations where B borrow is to be used should include the feasibility of compaction and the type of pavement surface being constructed.

If material within the contract limits substantially meets the SS requirements for B borrow and is readily available, this material must be used for the contract before any B borrow sourced outside the contract is used. In that event, the B borrow material should be paid as Common Excavation.

For certain locations such as Catch Basins, Inlets, and Manholes, as defined in the SS, no payment is made for structure backfill for these structures.

When the CIB contains a pay item of “B Borrow”, payment for the item will be made on the basis of the limits indicated on the plans or as adjusted through authorized changes, provided the material comes from outside the permanent ROW. The provision for adjustment by authorized changes is included to allow for substantial quantity adjustments due to plan error or omissions and changes to structures in the field. In those cases where an adjustment in the plan quantity is required, the theoretical amount should be computed for the individual structure in the normal manner and these computations kept in the contract file. A Change Order containing the adjustments required for B borrow should be submitted as soon as practicable for approval.

The method of and payment for B borrow should be discussed with the Contractor at pre-construction conferences and progress meetings.

3.19 PLAN QUANTITY PAYMENT FOR COMMON EXCAVATION

In accordance with 203.27 of the SS, quantities of excavation to be paid for will be those shown in the contract, unless extra work has been performed or either party disagrees.

The following procedure will apply to all contracts or portions of contracts that involve payment for Common Excavation on the basis of plan quantity:

- New original cross sections are to be taken at 500 ft intervals and plotted to check the accuracy of the original sections. (See section on Staking and Construction Engineering).

- Final cross sections are to be taken at 500 ft intervals at the same locations as the original sections. Cross sections should be complete sections in cuts and from the shoulder break out in fills. These final sections should indicate substantial conformance with the planned cut slopes and ditches. The sections will be used to determine if earthwork deductions are required.

- Spot checks must be made of the cross-section areas shown in the plans. The number of spot checks should average one for each 2,000 ft with the locations concentrated in areas of major excavation. Additional area checks should be made to determine whether the plan quantity should be adjusted if any of the areas checked varies more than 10% from the area shown on the plans. If the average deviation of all the areas checked varies from the total planned areas at the same location by more than 2%, a more detailed check will be required on those areas or balances showing the highest deviation.

Record the area checks as indicated above and included the information in the contract files. The documentation should have the heading "Comparison of Planned and Final Cut Areas for Check of Plan Quantity." The documentation sheet could then be divided into five columns with headings of: Station, Planned Area, Checked Area, Percent Deviation, and Remarks. The Percent Deviation column would be totaled algebraically and the average Percent Deviation would be listed.

The computation of the volume from the planned areas of one balance should be checked. In general, this should be the largest balance in the contract. Any other questionable balances should also be checked for volume computations.

Any other pertinent facts that would justify using plan quantity or indicating the need for adjustments should be considered. In addition to the above steps, the contract documentation should include the use of form IC 675 found within the AWP Reports page.

3.20 DEDUCTIONS

It is important that the PEMS and Contractor be familiar with deductions in excavation and Borrow quantities. It is essential that all notes and computations be accurate and complete to support any deductions made in accordance with established policy. Should circumstances justify waiving deductions, a full explanation should be written to fully describe the situation and signed by the PEMS.

When payment is made on the basis of plan quantity or computer facilities used for computation of pay quantities, sufficient documentation must be included in the contract files to indicate whether deductions are required. Sections plotted at 500 ft intervals should be used to verify whether deductions, in accordance with standard procedures are necessary. The completed contract should be visually inspected to determine whether there are other locations which warrant cross sections to check for deductions such as areas bounded by interchange ramps, areas between variable median sections, etc. When deductions are indicated, additional sections must be taken at the necessary stations to compute the deductible materials. A statement should be included in the contract files that the above check has been made.

3.21 SETTLEMENT STAKES AND GEOTECHNICAL INSTRUMENTATION

When the geotechnical investigation indicates a large or uneven settlement of the foundation soil under a proposed embankment is expected, fill movements during and after grading must be reviewed. This review is specified mainly for three reasons:

1. To detect foundation soil failures in early stages to prevent costly reconstruction.

2. To verify predicted settlement.

3. To determine when embankment settlement has slowed to the point that paving can be done without being excessively distorted by continued uneven settlement.

The checking of fill movement can be accomplished through installation of settlement plates, settlement stakes, lateral stakes, vibrating wire settlement systems, and standpipe piezometers. When any of these are required, details of their construction and use are set out in the CIB. These details should be carefully followed so that desired results will be obtained.

Vibrating wire settlement systems monitor settlement or heave at a particular point in soil. Two weeks prior to beginning operations, the Contractor shall submit a Type D certification and the manufacturer’s calibration report to the PEMS and to GS for the system selected.

The installation and operation shall be in accordance with the manufacturer’s instructions and the SS. Only hand tools shall be used to place and compact fill material for a height of 1 1/2 ft above the signal cable, tubing, and settlement plate.

All monitoring of the device will be performed by GS. They will keep a weekly record of the device readings. A copy of the weekly report will be provided to the PEMS.

Settlement plates are for observation of vertical movement of the original ground beneath a fill during and following embankment construction.

The PEMS will determine the plate elevation and the elevation of the top of the first section of pipe at the time the plate is set. As additional sections of pipe are added, their effective length must be carefully measured. Observations are to be made every 7 days to determine movement of the plates. These observations should start about 7 days after fill construction has started.

Results of settlement observations on the plates are to be reported weekly. This weekly report series should start with the first observations after fill construction has started. During winter months and periods of job suspension, the frequency of observations and reports may be decreased with proper approval. Observations and reports should continue until a written release from observation responsibility has been secured from GS.

3.22 SUBGRADE TREATMENT

Section 207 of the SS contains the requirements for subgrade treatment. In most cases, the Contractor may choose options for subgrade treatment. The plans and Standard Drawings should be reviewed for information on the treatment specified for the contract.

Recycled concrete pavement processed into coarse aggregate-sized material, No. 53, and ACBF shall not be used as coarse aggregate in subgrade treatment when an underdrain is specified.

3.22.1 Cement Stabilized Subgrade Soil

Subgrades may benefit by utilizing cement for the stabilization of the subgrade soil. When specified in the plans, the process consists of stabilizing 12 inches of subgrade by uniformly mixing Type I portland cement to achieve an unconfined compressive strength that is in accordance with the SS.

The process of determining the optimum cement content is the responsibility of the Contractor and must follow the same process as for determining optimum content for other chemical subgrade treatments. Mix design and test results, performed by a Department approved geotechnical consultant, are required to be submitted to the PEMS and the Department's Geotechnical Engineering Division five business days prior to use and are subject to approval. The Contractor must also submit a quality control plan addressing all testing requirements for the mixture.

Preparation of the existing soils, mixing, spreading, and compaction of the soil and cement mixture are to follow the requirements of the SS. Requirements for QC/QA testing of the mixture are also outlined within the Specifications.

The stabilized surface is required to be maintained in a moist condition for the first seven days after mixing. Liquid membrane forming compound is required to be applied to the surface, and reapplied as applicable, to aid in the curing and to prevent moisture loss. Proofrolling is required over the entire stabilized area. Deflections or ruts greater than specified must be corrected.

3.23 ARCHEOLOGICAL ARTIFACTS

An archeological artifact may be a fragment of historic or prehistoric pottery, chipped stone tools or flakes, ground stone tools, prehistoric or historic housing material, burial objects such as headstones, or even human remains. Other types of historic features may include a prehistoric garbage pit or cooking pit, the remains of a prehistoric house, a privy, well, canal features, building foundations, etc. Burial objects are of particular concern, they suggest the presence of human remains.

If any archaeological artifact or historic feature, including human remains, is found during construction, work must immediately stop within a 100 feet radius of the discovery site and the site must be left undisturbed.

For artifacts other than human remains, the PEMS must coordinate with IDNR to mitigate impacts to the discovery. Work at the site cannot resume until written consent is received.

If human remains are encountered, the local law enforcement agency must be contacted first by the Contractor or the Department, and then ES must be notified. The law enforcement agency will contact the County Coroner. Although human remains may appear archaeological or historic, they may actually represent a modern or historically recent crime scene. This is why the County Coroner always documents the remains. It is very important to leave the area of the discovery as undisturbed as possible.

3.24 REGULATED MATERIALS

Hazardous materials are considered to be regulated materials and must be handled in accordance with applicable environmental laws, regulations, and rules. The SS clearly address all the requirements that the Contractor must deal with when working with regulated materials within 104.06 and 202. However, disposal of bridge coating debris shall be in accordance with 619. The PEMS must see that the Contractor follows the SS pertaining to regulated materials.

When materials suspected of being regulated are encountered on the project site or are identified in the contract documents, the Contractor must cease all operations in the immediate vicinity and the PEMS must notify the AE. If the situation warrants an immediate emergency response, the procedures as outlined in 104.06 of the SS must be followed.

The DCD will work with District Environmental concerning any necessary handling, cleanup, testing, transportation, and disposal of such materials. District Environmental may contact ES for further guidance and coordination with IDEM.

A private consulting company may be necessary for testing of suspected regulated materials. This consultant may be acquired and paid by the Contractor or the Department. ES and IDEM, if required, would review the results of any such tests. The PEMS should be advised, through the DCD, of procedures for the Contractor to follow. The Contractor may be advised of any required handling, storage, cleanup, additional testing, transportation, or disposal of hazardous materials.

The Contractor should not resume work in any affected area until notified that conditions and the area have been rendered safe for resumption of work.

Payment for the Contractor’s work related to storage, cleanup, testing, transportation, or disposal of any such materials should be in accordance with 104.06 and 202 of the SS.

Removal of UST shall follow 202 of the SS. The Contractor and PEMS must maintain accurate records of all operations. The Contractor shall submit two additional copies of the compulsory completed report distributed to IDEM UST Branch (Notification for UST & UST System Closure Site Assessment Report) to the PEMS within 30 days after closure. One copy shall be forwarded to ES. The second copy is retained in the contract file. In addition, a copy of all detailed pay item costs, with justification and calculations relating to the UST removal, will be submitted to ES. This documentation is needed so the Department may submit cost reimbursement from the Excess Liability Fund (ELF) for the removal of the UST's to IDEM.

3.25 ASBESTOS CONTAINING MATERIALS

The Contractor is required to comply with all applicable laws and regulations concerning the inspection, testing, and removal of asbestos material. Asbestos containing materials are considered to be regulated materials and must be handled as such. The SS explain in detail what procedures the Contractor must follow when handling this type of material in 104.06 and 202.07. Such regulations require an inspection for the presence of asbestos in buildings, bridges, and pipes to be demolished or renovated. The inspection must be performed before the start of demolition or renovation operations. In this regulation, renovation is defined as the disturbance of any load-carrying member. In bridges, this term has been defined as work involving any substructure element.

Persons who inspect for asbestos containing materials must have a current certificate of accreditation, issued by IDEM. Also, only accredited asbestos removal contractors, supervisors, and workers can be employed on asbestos removal operations. Listings of accredited inspectors, and asbestos removal contractors and persons, can be obtained from IDEM's Office of Air Quality website.

IDEM requires written notification 10 working days prior to the start of renovation or demolition operations, even if no asbestos is found during the inspection. IDEM's notification form must be filled out completely and accurately. The start of work date must be as accurate as possible. If work will not start on the date shown on the form for some reason, a new notification must be made. Copies of the same form may be used to satisfy the notification requirements of the US EPA, and the Indianapolis Bureau of Environmental Services for such operations in Marion County. There are specified waiting periods between notification and asbestos stripping or removal that must be followed.

Section 4:

Small Drainage Structures

SECTION 4 – SMALL DRAINAGE STRUCTURES

4.1 GENERAL

The construction of well built structures that will adequately accommodate drainage, both surface and subsurface, is an important responsibility. Failure in our road surfaces and complaints from property owners along the highway will result if the construction of proper drainage structures is not given careful attention.

If time permits, the PEMS should obtain a copy of the drainage design calculations and check for errors or discrepancies in information, such as land use. An examination of existing structures after a heavy rain or reviews of local inquiries as to the adequacy of the existing structures are two sources of valuable information. District Maintenance is a good source to obtain past drainage complaints from the public.

If Construction recommends drainage revisions, those recommended revisions should be reviewed with the Designer, through the PM, and any changes agreed upon should be implemented by Change Order.

4.1.1 Structure Sump Requirements

IDEM requires small structures to be constructed so that after construction native stream bed material will be naturally deposited along the flowline of the stream within the structure limits.

To achieve this requirement, pipe structures, box culverts, and 3-sided culvert structures are designed with a specified sump depth. The sump depth is a defined depth below the designed flowline elevation and the invert for pipes or top of scour protection for culverts. Figure 4.1 shows a typical section through a 3-sided culvert that includes the sump depth. The PEMS should review the plans and Standard Drawings for a better understanding of the sump depth and for the specific depth requirement for each structure.

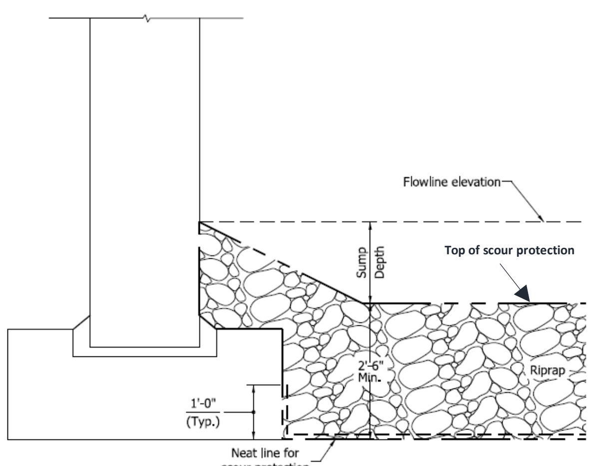


Figure 4.1. Sump Depth Indication for 3-Sided Culvert

Since the intention is that natural stream bed material is desired to be deposited along the stream channel, the PEMS should ensure that the sump depth of a structure is constructed correctly. Upon completion of the work, this will leave the structure in a condition that accumulates water in the sump area. This is the intent. During the contract, no material should be placed to fill the sump unless otherwise directed.

4.1.2 Precast Reinforced Concrete Box Structure Joints and Waterproofing

Precast reinforced concrete box structure joints must be sealed to provide a watertight joint and reduce the potential for infiltration. Pipe joint sealant is required to be applied, in accordance with the manufacturer's recommendations, to the bell or spigot end of the structure sections prior to joining the sections. Unless indicated on the plans, joints are covered using a joint membrane in accordance with the Standard Drawings and 907.07 of the SS. The sealer system or membrane material is centered across the joint and rolled to avoid wrinkling. Three inches of overlap are required if the roll of geotextile or membrane material does not cover the full length of the joint.

If specified within the plans and contract documents, a waterproofing membrane will be required to be applied to joints, exterior vertical surfaces, and the exterior top horizontal surface of the structure in their entirety. A Type 2 waterproofing membrane is to be used for all external vertical surfaces. When asphalt is to be placed directly on top of the waterproofing membrane, Type 3 waterproofing membrane is to be used. Otherwise, the use of Type 2 waterproofing membrane is appropriate.

Concrete surfaces must be clean and dry, free of dust and loose materials, and be smooth and free from projections and holes. The PEMS must verify that all joints and exterior corners are prepared in accordance with the waterproofing membrane manufacturer's recommendations. Waterproofing membrane is to be applied when the ambient temperature is 40^{o}F and rising in accordance with the SS. Prior to placing Type 2 waterproofing membrane, a manufacturer's recommended prime coat is applied to all exterior surfaces receiving the membrane.

Waterproofing membrane must be placed from bottom to top of the vertical surfaces. Waterproofing membrane placed on the top horizontal surface must overlap the membrane on the exterior vertical surfaces by a minimum of 12 inches. The installation of Type 2 or Type 3 waterproofing membrane are to follow the methods described within the SS and the manufacturer's recommendations.

4.2 COUNTY DITCHES

Legal drains, whether open ditches or piped, have legal flow lines that have been established by the county authorities.

Before any structures under the roadway are staked, the location of the county ditches and the legal flow lines thereof should be obtained from the County Surveyor. Where a legal flow line can be established, the datum on the county ditch should be equated to that on the road plans. The flow lines of pipes or boxes should be placed at or below the legal flow lines.

4.3 STAKING STRUCTURES

Structures should be staked at plan location and flow line. Minor changes are frequently necessary to fit existing ground conditions and should be approved by the PEMS prior to installation. The upstream end of structures under the roadway should be 0.2 ft to 0.5 ft below the lowest ground, ditch, or tile ditch to be drained. The grade then should be approximately straight to the point where the water will leave the right-of-way. The minimum distance from the edge of pavement to the inner face of headwalls on boxes, and under fill slab tops are required to meet clear zone requirements. Headwalls and handrails should be parallel to the pavement. If they are visible to traffic, the top should be parallel to the grade of the pavement. Pipe structures parallel to the centerline at intersecting roads shall be constructed according to the standards for the type of intersection shown on the plans.

4.4 FOUNDATIONS

Structures should be placed on stable foundations. The SS state that unstable material excavated below the planned foundation of the structure be paid for at three times the bid price for the class of excavation involved, providing the additional amount involved at the structure exceeds 10 cu yd. This additional excavation should usually be backfilled with B Borrow and paid as a separate item.

Tests should be made on the stability of foundations for slab top culverts. If the foundation is unstable, piling will be required unless the unsuitable material is shallow enough that it may be excavated and the footing lowered. If large quantities of unstable material are encountered, the AE should be contacted for approval of the method required to stabilize the structure foundation.

Follow recommended procedures for structural foundations found within the Geotechnical report for the contract.

Structures should never be placed or foundations built on frozen ground.

4.5 BUILDING FORMS AND PLACING STEEL

Before each concrete pour, both forms and reinforcing steel should be carefully and thoroughly checked. Forms should be checked for stability and strength as well as dimension. All lumber in contact with the concrete shall be free from knot holes, splits, warps, and other defects. Forms for the portion of the structure that is to be finished by rubbing should be lined with plywood or other approved material that will leave a surface free of board marks. Exposed edges should be checked for correct size of bevel or chamfer strips.

The SS provide that forms are tied together with a combination tie and strut, the outside 1 in. of which can be removed, and its hole filled with mortar. A wall form properly tied will not need wood struts. Wire ties shall not be used.

Footings or floors should be thoroughly cleaned before abutment or wall concrete is placed on them.

Reinforcing steel should be secured so that it will not shift during the placing of concrete. Steel which has a detrimental scale or rust shall be cleaned. In no case shall steel be used which is rusted deeply or pitted. New steel can be maintained in good condition by storing it on skids and covering it as described by the SS. Any dirt or other foreign material should be removed from the reinforcing steel before placing concrete.

4.6 CONSTRUCTION JOINTS

Horizontal and vertical construction joints shall only be placed as shown on the plans or as approved by the Designer.

4.7 PLACING STRUCTURAL CONCRETE

The Contractor should not be allowed to start a concrete pour until forms and steel have been checked by the PEMS.

The SS require a slump between 1 and 6 in., except otherwise indicated within the contract documents. Between these limits the concrete should have as low a slump as will flow into a mass which is free of honeycombing. A higher slump will be required for thin box walls rather than for footings of a slabtop.

In order that concrete can be properly consolidated, the SS require that wall sections be placed no greater than 24 in. layers. Each succeeding layer should be placed before the previous one has initial set. The SS require the use of vibrators for consolidation. The vibrator should follow immediately behind the placing of each lift of concrete, being lowered and directly lifted out at about one foot intervals. Vibrators should not rest against the forms or reinforcing steel and should not be dragged through the mix. Vibrations transmitted to partially set concrete seriously impair its strength. Vibrators left running in the mix must be avoided.

Foundation seals are to be constructed from Class A concrete with the thickness as shown on the plans, or as requested by the Contractor and approved by the Department.

The SS should be followed for testing and acceptance of cast-in-place structures.

4.8 PLACING STRUCTURAL CONCRETE - COLD WEATHER

The SS require concrete mixing water, aggregate, or both to be heated when concrete is placed or cured at or below a specific atmospheric temperature. It also states that suitable enclosures and heating devices shall be provided. This entails heating the concrete both before and after placing. The temperature to be maintained is specified in 702 of the SS.

The Contractor should keep a watchman on the job, during the heating period, to ensure the maintenance of proper temperature. The Contractor should also maintain appropriate fire protection equipment at the job site during heating operations. Any concrete placed when the air temperature is at or below the SS specified cold weather concrete temperature will be at the Contractor's risk.

The use of admixtures to prevent freezing of the concrete are not permitted.

4.9 FINISHING

All concrete surfaces must be given a finish in accordance with the SS after removal of forms. Attention should be paid to filling air holes and irregularities. All joints and chamfers must be power ground to a smooth finish.

4.10 SKEWED STRUCTURES

Where box culverts are placed on a skew, the dimensions of the box, as shown on the plans, are measured perpendicular to the centerline of the structure. On skewed slab top structures, the span, as shown on the plans, is measured parallel to the road centerline.

4.11 PIPE CULVERTS

The trench in which the pipe is to be laid shall be cut to conform to the bottom of the pipe thus ensuring a uniform and even bearing on solid compacted material. The bedding at the bell end must be recessed into the bedding so no bearing occurs on the bell end.

The Contractor must use proper construction methods when laying pipe culverts. It is important that Department personnel inspecting this work are familiar with the requirements of the SS and see that the methods outlined therein are met.

Under certain conditions, corrugated metal pipe must be strutted. Refer to the SS to determine the applicable provisions for strutting. This strutting is performed prior to shipment of the pipe and should be left in place until the entire backfill for the pipe is in place and compacted.

Before the final inspection of the contract, all pipe structures must be inspected for damage to the bituminous coating or paved invert, when these types of pipes are specified.

4.11.1 Inspection of Pipes

All pipes, except underdrains, must be visually inspected no earlier than 30 days after completion of the backfill for indications of joint failures, excessive deflection, or other damage. If a pipe cannot be visually inspected, the Contractor must provide for video inspection of the pipe.

The PEMS should review the contract quantity for the video inspection pay item and use the quantity to provide inspection for those sections of pipe that present the most risk for joint failure, excessive deflection, or other damage. Video inspection of pipes is covered in 715 of the SS.

For more information regarding the items below and pipe inspection, refer to the *Inspection Manual for Pipe* found on the M&T website.

- Pipe Structures
- Pipe Placement
- Measurements of Pipe Items
- Manholes, Inlets, and Catch Basins
- Structure Backfill and Inspection
- Relining Existing Pipe Structures

- Calculating Pipe Lengths
- Concrete Pipe
- High Density Polyethylene (HDPE) Pipe
- Metal Pipe
- Metal Pipe Structures
- Polypropylene Pipe
- Polyvinylchloride (PVC) Pipe
- Reinforced Thermosetting Resin Pipe
- Utility Pipe.

4.11.2 Mandrel Testing of Thermoplastic Pipe

For the purposes of these instructions as well as the SS, the terms nominal diameter, pipe pay item diameter, and pipe pay diameter are synonymous. The SS requires that thermoplastic pipe be in accordance with either AASHTO or ASTM specifications. The nominal pipe size or nominal pipe diameter, the AASHTO or ASTM designation, as well as other identifying information, (the product marking line) is required to be stamped on the pipe at regular intervals. The PEMS should use this information to ensure that the correct material is being used on the contract.

Thermoplastic pipe (HDPE or smooth wall PVC) must be mandrel tested after the visual or video inspection has been completed and reviewed. The pipe materials that fall into the thermoplastic pipe category are polyethylene and smooth wall polyvinyl chloride pipes that are in accordance with SS 907.17(b), 907.19, 907.20, 907.21, 907.22, or 907.23. The pipes material types requiring mandrel testing are indicated within 715.09 of the SS.

A mandrel is a device with arms or prongs that is pulled by hand through a pipe to check that the pipe does not exceed the maximum deflection criteria allowed by the SS. Prior to a mandrel test, the inspector must check the mandrel to ensure that the diameter of the mandrel is 95% of the nominal pipe diameter that is stamped on the pipe. The mandrel test is a pass or fail test.

Form IC 715, Mandrel Testing of Pipe Structures, is to be used by field personnel to document mandrel testing of thermoplastic pipes. A copy of this form available on the Department's website.

The following procedure is to be followed for mandrel testing:

- Determine which pipe structures will require mandrel testing and note them on an IC 715 along with the pipe material specification reference (i.e. – 907.19), nominal/pipe pay diameter and pipe structure length.

- Note the date that the backfill is completed for each structure.

- Visually inspect the pipe no earlier than 30 days after backfill has been completed. Look for obvious damage, such as excessive deflection or joint failures.

- If the pipe cannot be visually inspected, require the Contractor to perform a video inspection of the pipe. Review the results of the video inspection for damage.

- After the visual or video inspection, require the Contractor to perform the mandrel test. Note the mandrel requirements in the SS and check the mandrel to ensure that it has a diameter that is no less than 95% of the nominal/pipe pay diameter.

- Note the date of the mandrel test on the IC 715.

- Have the Contractor pull the mandrel through the pipe by hand.

- Record the result, either pass or fail, on the IC 715 for each structure tested.

If the pipe fails the mandrel test or the mandrel causes obvious damage to the pipe, require the Contractor to remove and replace the deficient portion of the pipe. The deficient portion should be removed and replaced to the nearest pipe joint or structure, such as a manhole or inlet.

Lengths of pipe replaced must be mandrel tested in accordance with the procedure outlined above. A note should be made on the IC 715 that the test is being made for a replacement pipe.

All IC 715 forms are to be kept in the project file and a copy sent to CM.

4.11.3 Thermoplastic Slip Lining Existing Pipe

In certain situations, the plans may indicated that existing pipes be rehabilitated by slip lining with a thermoplastic liner rather than replacing the structure. The plans will indicate whether a circular or deformed liner will be used as well as the maximum number of joints and the corresponding maximum length of each section of liner pipe.

The Contractor may submit a written request to use a liner pipe that is longer than indicated in the plans. The Contractor's written request must also address the change in the number of joints associated with the requested liner length. The Contractor must select the liner pipe from the Department's list of approved Plastic Pipe and Pipe Liner Sources, or provide a certification, in accordance with 907.25 and 4.23 or 4.24 of ITM 804, for liner pipes not on the approved sources list. All liner pipe must be submitted for review prior to installation.

(a) Materials

When circular liner pipe is shown on the plans, the choices for lining the existing pipe structure include:

- solid wall HDPE liner pipe,
- profile wall HDPE liner pipe, or

- profile wall PVC liner pipe.

When deformed liner pipe is shown on the plans, the only choices for lining the existing pipe include:

- solid wall HDPE liner pipe or
- profile wall HDPE liner pipe.

The cellular grout used for the filling of the annular space between the inside of existing pipe and the outside of the liner is accepted in accordance with the Frequency Manual under the heading of Cellular Concrete Grout.

(b) Quality Control

The Contractor is required to submit a QCP, in accordance with ITM 803, for acceptance by the PEMS prior to the start of the lining operation. The QCP should be contract specific and contain a description of the proposed work for the lining operation including:

1. Name of the QCP Manager, their qualifications, contact information, and duties.
2. Sequence of the pipe lining operation.
3. Equipment and method used to deform the liner pipe.
4. Destructive test method for welded, butt-fused, or joined liners.
5. Method used to calibrate the cellular grout pump gauges.
6. Methods used to achieve proper placement of the cellular grout.
7. Identification of potential problems with the lining operations, including possible grout leakage, and the proposed resolutions.

A QC representative is required to be on-site for the initial testing of the first welding or fusing of the liner pipe at each installation location and for the joining, welding, or fusing of the liner pipe at each location.

(c) Joints

Liner pipes have the option to be joined using a variety of methods including:

- Bell and spigot
- Screw type
- Grooved press-on
- Butt fused

- Extrusion weld
- Other joint as recommended by the liner pipe manufacturer.

Welded liners shall have a continuous weld bead both inside and out. The welding bead shall be smooth, protrude no more than 3/8 in. into the interior of the liner, and not adversely affect the hydraulic capacity of the liner.

The operators performing welding, butt-fusing, or joining for the liner pipe shall be trained and certified by either the liner pipe manufacturer or the welding, butt-fusing, or joining equipment manufacturer. The PEMS shall be provided a copy of the operator's current and valid certification prior to the beginning of any joint work.

A demonstration of the method described within the QCP for destructive testing of the joint should be performed by the operator for all welded, butt-fused, and joined liner pipe. The operator shall perform the destructive test at the beginning of each day's joint operations.

All pipe liner joints shall be in accordance with the manufacturer's recommended procedures, and be visually inspected before acceptance. Any joints that do not pass the visual inspection should be removed and a new joint should be fabricated. The re-fabricated joint will be visually inspected prior to acceptance.

(d) Installation

Installation of the liner pipe begins with the cleaning of the interior of the existing structure and the repair of all deformities. After cleaning, a walk through should be performed in order to visually assess the condition of the existing structure. If a walk through cannot be performed, the Contractor is required to perform a video inspection. The PEMS should receive a copy of the video. If the Contractor believes that the work cannot be performed as planned after the visual inspection, the PEMS must be informed immediately and discussions with the Designer must occur.

The Contractor may desire additional area for their installation operations beyond the right-of-way limits provided in the contract. In this situation, the Contractor is responsible to pursue agreements from adjacent property owners in accordance with 107.14.

After cleaning of the existing pipe, the Contractor should check the size of the liner pipe to verify that the required cross-sectional area can successfully be placed inside the existing structure. If problems are found to exist before the installation, the Contractor must submit a substitute liner pipe plan to the PEMS for approval. If problems are not discovered until installation has begun, the Contractor is required to remove the portion of the liner pipe already installed and submit a substitute liner pipe plan to the PEMS for approval.

All visible and obvious cavities outside the existing structure should be filled with non-removable backfill, in accordance with 213, prior to the start of the lining operation. If the Contractor's QCP indicates that the cavities are to be filled in conjunction with the grouting operation, cellular concrete grout should be used in lieu of non-removable backfill.

Prior to filling the annular space between the existing structure and the liner pipe with cellular grout, bulkheads should be built on each end of the structure. The bulkheads should be free of leaks and should be strong enough to withstand the pressure of the injected grout. The bulkheads should extend from the end of the existing structure inward to a minimum thickness of 18 in. The exterior surfaces of the bulkheads should be given a smooth troweled finish.

The injection method used to place the cellular grout is required to be explained within the Contractor's QCP and should be monitored during placement so that the grout completely fills the annular space between the existing structure and the liner pipe. The grout injection methods must not cause distortion of the liner pipe, nor cause the liner pipe to float. Within the QCP, the Contractor must explain the methods to be used to regulate and maintain injection pressure. These methods should be based on the liner pipe manufacturer's recommendations.

Any stormwater management features installed, including pump arounds, should be monitored during the cellular grout injection operation. Grout will follow the path of least resistance in its attempt to fill existing voids and reduce injection pressure. If the grout is found to be leaking into any adjacent body of water or other potential problematic areas, operations should be stopped. Any leakage should be identified and corrected prior to re-starting the operation. After the restart, all adjacent areas should continue to be monitored for grout leakage.

Any existing drainage structures connected to the structure being lined must be perpetuated and kept free of the injected cellular grout.

(e) Payment

Payment for the total length of thermoplastic liner pipe will include the measured length of the existing pipe that has been lined plus a maximum of 8 in. beyond the end of the existing structure.

For example, if a thermoplastic liner pipe is used to line an existing 20 ft cross structure with 10 in. extensions on either end of the liner, the total payment for the liner would include the measured length of the existing cross structure plus the maximum 8 in. length extending beyond each end of the existing pipe

$$20\ ft + \frac{(2 \times 8\ in.)}{12\frac{in}{ft}.} = 21.33\ ft.$$

In some cases, the design may indicate that specific types of end sections are to be installed on the liner pipe. These specific end sections may be indicated as a separate pay item. For the special situations in which a separate pay item has been included for the end sections, payment should be made for the specified end sections in addition to the payment of the liner pipe.

Payment for the liner pipe is intended to be all inclusive, except when end sections are identified to be installed as described above. The payment should take into account all necessary work and all incidentals for the work required. Perpetuation of existing structures connected to the existing pipe are required to be paid separately for each pipe perpetuated.

4.12 PRIVATE ENTRANCE STRUCTURES

Private entrance structures shall be placed where such structures are shown on the plans, where private entrances or drives existed prior to the award of the contract, and where drainage structures are identified to be needed.

Approaches at private drives or entrances shall not be graded at Department expense beyond the right-of-way unless specifically indicated in the plans. Approach grading is discussed further in Section 19 of these instructions. It is the policy of the Department to perpetuate access to all properties, although the plans may not provide for the same number or same location of drives.

If any property is not being given access or existing drives are shown to be eliminated, contact your AE to determine how to proceed. Any changes in locations of private drives to satisfy the property owner should be requested in writing by the property owner. Discuss such requests with the AE if the change is in contradiction with the special provisions of the right-of-way grant or could otherwise become a controversial matter.

4.13 TILE DRAINS

Accurately locate all tile drains crossing the contract or affected by the construction and make adequate provision for taking care of them. This can be accomplished only by consulting with the property owners and by making a careful study of the ground. The study of the ground is necessary because property owners frequently do not know the tile location, particularly when tile drains were placed by former owners.

Where farm drains cross the road, every precaution should be taken to preserve them in their original state of efficiency. Tile drains shown on the plans to be left in place and damaged by the Contractor, must be replaced by the Contractor at no additional cost to the Department. Tile drains, which are discovered before any work is performed and are not shown on the plans, should be marked on the As-Built plans. In general, farm tile located under the roadway, with a diameter of 6 to 10 in., and located 4 ft or less under the ground surface should be replaced with sewer pipe. Farm tiles located under the roadway and are 12 in. or larger in diameter should always be replaced with pipe that meets the SS for structures under pavement.

Drain tile paralleling the roadway, but not located under it, may be replaced in kind.

When a farm tile is intercepted by ditches that provide adequate drainage for the tile, at least two sections of sewer pipe and a sod collar should be placed on the outlet end. The balance of the tile under the road shall be removed and replaced in accordance with the information described above and the SS.

If it is necessary to excavate for the purpose of locating underground drainage, the accepted cubic yards involved will be paid for as per 203 of the SS.

Drain tile may be encountered which appears to be abandoned or no longer used for drainage purposes. Do not assume the tile is “abandoned” or does not need replacement until a thorough investigation has been made to determine its status.

4.14 SUBSURFACE DRAINAGE

The locations of subsurface drains are shown on the plans. The grades for these drains may also be shown on the plans. It is necessary to coordinate the subsurface drain grades with the grades of culverts located under the pavement. Wherever practicable, the cross structures should be low enough to outlet the subsurface drains. Otherwise the subsurface drain should be low enough that the culvert will not lay directly upon it.

On some projects GS makes specific recommendations for subsurface drainage, other than the subbase drain through cuts referred above. These recommendations, along with the conditions observed as cuts are opened, should be reviewed with the AE based on anticipated modification and actual field conditions.

Perforated subsurface drainage pipe is placed with the perforations down. This assists in the prevention of infiltration of silts, gravel and other solids that might clog the line and destroy the effectiveness of the system. It is important that the perforated lower portion of the subsurface drain is placed so the rows of holes are symmetrical with respect to the vertical axis of the pipe.

The laying of pipe or drain tile and its backfilling is adequately covered in the SS. The provisions should be carefully followed. In addition, care must be taken to ensure that the top of the backfill is clean and free of any foreign material when the subbase material is placed over the subsurface drain backfill material.

4.15 GEOTEXTILES USED WITH UNDERDRAINS

Filter fabric, or geotextile, is normally used where silty soil is encountered within the immediate subgrade. The geotextile, when specified, should be placed along the sides and bottom of the trench before placing any subsurface drain aggregate backfill. Geotextile should not be used on the top of the trench unless indicated in the plans or approved through GS.

Storage and handling of geotextiles should be in accordance with the manufacturer’s recommendations, except in no case should the geotextile be exposed to direct sunlight, ultraviolet rays, temperature greater than 140°F, mud, dirt, dust and debris, to the extent that its strength, toughness, or permeability requirements are diminished. Each geotextile roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. At the time of installation, the geotextile should be rejected and replaced with no additional payment if defects, rips, flaws, deterioration, or damage incurred during manufacture, transportation, or storage is evident.

The surface on which the geotextile is to be placed should be excavated to design grade to provide a smooth, graded surface free of debris and large cavities. After excavating to design grade, the geotextile should be cut to a width to provide for a loose, no wrinkle placement in trenches and overlaps of the ends of adjacent rolls.

The geotextile should be placed with the machine direction (length) in the direction of water flow in the drainage system. It should be placed loosely, but with no wrinkles or folds. The ends and edges of subsequent rolls and parallel rolls should be overlapped a minimum of 1 ft. The upstream geotextile should always be overlapped over the downstream. Either sewing or overlapping shall join seams required in the longitudinal direction. Overlapped seams shall have a minimum overlap equal to the width of the trench.

Care should be taken during construction to avoid contamination of the geotextile. If it becomes contaminated, it must be removed and replaced with new material.

Placement of drainage aggregate should proceed immediately following the placement of the geotextile, when specified, and the underdrain.

4.16 STORM SEWERS

In general, manholes are placed at the junction of storm sewers and at every change in grade or alignment of the storm sewer. This means that sewers should ordinarily be constructed with straight pipe runs between manholes to facilitate inspection and repairs.

Since the survey crew cannot always determine the exact location and elevation of existing storm sewers, utilities, and other underground installations, it is imperative that the PEMS make additional investigations as necessary. With these additional investigations, it is possible to avoid costly delays or revisions in storm sewer installation. Do not postpone investigating the underground installations until sewer construction actually begins.

Catch basins and curb inlets are provided for receiving stormwater from the surface into the underground storm sewer system. The plans must be followed when installing catch basins and curb inlets to manholes within the storm sewer system.

4.17 SEPTIC TANK DRAINS

In small towns and rural communities, frequent requests are made from property owners for the privilege of connecting septic tank drains to the Department's storm drainage system, underground or surface. In some instances, our improvement eliminates an open ditch formerly used for such purpose, and the property owner assumes they have the right to perpetuate the arrangement.

The normal type of septic tank used in residential applications does little more than liquefy the sewage. A filter bed or soil filter is needed before the effluent is safe in an open ditch. However, the local public health official is better qualified to pass judgment on the efficiency of such treatment and the purity of the effluent. The Department does not permit septic tank drainage into our storm sewers or side ditches. If you find that sewage is drained onto Department right-of-way, contact the AE and the appropriate local public health official for further investigation and action.

4.18 EARTH DITCH TYPE CATCH BASINS AND INLETS

On rural projects earth ditch type catch basins or standard pipe catch basins are often specified.

Except in special cases, these catch basins should not be located in the line of existing drain tile. They should be offset to one side of the drain tile and connected to the tile by means of a “Y” or “T” connection.

The outlet of pipe catch basins should be of smaller diameter than the catch basin. The outlet for a 2 ft diameter concrete catch basin should not be larger than 15 in. Where a larger outlet pipe is required a 4 ft diameter concrete catch basin should be used.

It is not Department policy to place catch basins or inlets on private drain tile lines, nor to carry surface drainage into private drain tile systems. When special cases are encountered, requiring deviation from this policy, those cases should be discussed with the AE.

4.19 STRUCTURE REMOVAL

Normally, no payment is made for removal of existing structures unless the contract contains an item for “Removal of Structures and Obstructions.” If a contract price is not listed within the CIB, a USP should have been included within the CIB stating the cost of removal is to be included in various pay items of the contract.

4.20 RECORD OF STRUCTURES

Complete documentation of a structure installation will consist of information indicating the exact location of the structure, cuts furnished by the Contractor, and a record of all pay quantities placed in the structure. All metal pipe is required to be produced by manufacturers listed on the QPL. This documentation shall be provided by the Contractor if they are performing construction engineering, otherwise they must be performed by the PEMS.

A record of the concrete required and the concrete used should be included. The amount of structure backfill used and paid for should be entered in the structure documentation. The payment for the installation is stored within the current construction records application. Revisions to structures should be included within the As-Builts and must include all structures or parts of structures that are not built to standard designs.

In order for Department maintenance personnel to have a record of underdrain outlet locations, the PEMS is to prepare a table when the project is complete that shows the stationing of each underdrain outlet. The best method for preparing the table is to use the underdrain table in the plans and indicate the as-built locations of the outlets. A copy of the as-built table is to be submitted to the District Highway Maintenance Director when the FCR is submitted.

Additionally, when culvert modifications, repairs, linings, or replacements are performed as part of construction contract work, communicate the culvert changes through email to the appropriate Senior District Bridge Inspection Engineer (for large culverts) or District Small Culvert Engineer (for small culverts).

Refer to Operations Memo 13-02 for additional information. Contact the District Bridge Inspection team for further information or questions.

Section 5:

Bridges

SECTION 5 – BRIDGES

5.1 INTRODUCTION

When assigned a bridge contract, the PEMS must become familiar with the contract documents and specifications governing the work. A review should be made of the work. Anything not understood should be discussed with the AE. Contract personnel should keep themselves informed of the Contractor's schedule and the rate of progress so the contract is completed on time with the least amount of inconvenience to the traveling public and other contracts in the area. At any time, the PEMS should discuss problems with the AE.

The PEMS must make frequent reference to the SS and contract documents as each phase of the work begins. If the Contractor questions the intent of the contract documents or SS, consult the AE. A Contractor's statement that something was permitted on another job should not affect judgment or reaching a determination if the statement is contrary to the SS.

Inspection of the work, in all phases, is required. The time to correct improper work is when it occurs. Do not wait until the work has been completed. The PEMS should never act as a foreman for the work. Instructions should be given directly to the Contractor or to their representative in charge of the work.

During the review of the work, the PEMS should compare all elevations between the substructure and the superstructure with the details in the plans. A check of all vertical and horizontal controls should be made. Any discrepancies must be brought to the attention of the AE and the Contractor.

The provisions of the SS must be enforced. The PEMS should remember that the management of the work is the responsibility of the Contractor. If the Contractor attempts to use any method which the PEMS has a reason to believe will impair the quality of the work, communication with the AE should occur.

The PEMS does not have the authority to alter or enlarge upon the contract documents or SS. Consent to any work in violation of them should not be given under any circumstances. If conditions should arise, which would indicate that it is impractical to enforce the SS to the letter, or if instructions are disregarded, the PEMS should immediately contact the AE.

5.1.1 Bridge Inspection

Bridge inspections are required to be performed by the Department's Bridge Inspection Office, or their authorized representative, on each bridge within the construction limits of a contract. Portions of each bridge replaced, reconstructed, or repaired and subsequently used for maintenance of traffic will be inspected within 60 days of being opened to traffic. The PEMS must notify the Bridge Inspection Office by email after each phase and when construction has been completed for each bridge included in the contract. This notification is intended to assist the Bridge Inspection Office in scheduling inspections.

The email notification should include the:

a) contract number,
b) DES number,
c) New Bridge Inventory number, and
d) structure number.

Bridge inspections will normally occur no less than seven days after notification by the PEMS. Access, coordination, and cooperation for the required bridge inspections should be provided to the Bridge Inspection team.

5.2 SAFETY

One of the basic requirements when working on bridges, as well as other construction projects, is to have a thorough knowledge and understanding of safety precautions to be used for any phase of work involved. Be alert to the surrounding activities and keep attention centered on the safety precautions necessary for the current activity.

5.3 STAKING OUT THE WORK

Construction engineering is outlined in 105.08 of the SS. Control stakes for bridge work should consist of sufficient control for the centerline of the roadway, centerline of the piers and bents, and the neat lines of abutments. It may be desirable to stake curb lines and any other permanent working lines that may affect the horizontal control of the units of the structure. Particular attention must be given to setting horizontal control stakes for structures that are located on curves or structures on which the centerline does not coincide with the centerline of the road approach. After the structure is properly located, permanent hubs should be set beyond the limits of the work and properly protected. The staking crew must check the horizontal and vertical leading measurements of the substructure against the measurements of the superstructure to ensure the work will fit satisfactorily.

After the centerline of the road is established for a railroad grade separation, the stations of the piers and substructure units should be located. The location of the piers shall be made with a direct measurement of the dimensions given on the plans starting at the centerline of the track in each direction to the centerline of the adjacent piers.

After the structure is staked, it is important to double check all leading dimensions. Accuracy of measurements, both horizontal and vertical, is of particular importance in bridge construction.

A temporary benchmark should be established and located conveniently near the bridge site for use during construction. As soon as the first bridge seat or top of pier is established and completed, the elevation for all other points on the structure shall be established using the first completed substructure unit as a benchmark.

When the structure is a grade separation, the clearance points, as shown on the plans, should be checked and recorded , and if necessary, the elevation of this structure should be adjusted to maintain the proper clearances. The DO should be consulted on any minor adjustments necessary. The DO in turn should advise the CO whenever an adjustment is necessary.

Upon completion of the work, a sketch shall be recorded showing the actual measured horizontal and vertical clearances.

Before any elevations are set, a check should be made between two benchmarks. If two benchmarks are not available, a check should be made between the available benchmark and an object of known elevation.

5.4 BRIDGE SEATS

The elevation of the bridge seats is one of the most critical elevations governing vertical control of the construction. Bridge seat elevations must always be checked before they are established.

The first step in determining these elevations is to determine the profile grade elevation for the intersection of the centerline of beam or girder with the centerline of the bearing.

For structures on a curve, this grade elevation should be determined for the intersection of the edge of the beam at the side where the floor is the lowest and the centerline of the bearing.

The following items should be considered in finding the difference between profile grade elevations and the bridge seat elevations:

1. Amount of crown or superelevation
2. Depth of bridge deck
3. Depth of beam or girder (Minus thickness of top flange if it is encased)
4. Splice plates (on older structures with beams spliced over piers)
5. Shims
6. Height of bearing assembly.

5.5 FOUNDATION EXCAVATION

Poor foundations are a potential cause of bridge failure. A careful examination must be made of the foundation soil at the location of each footing. When piling is not used, the foundation soil should be firm and unyielding. The PEMS must reference the Geotechnical Report for identification, recommendations, and precautions for soils within the contract. These precautions are based on the borings and explorations of GS for the specific contract. If this situation is present and before proceeding with the placing of the concrete for the footing, the use of piling should be discussed with the AE. Before any consideration is given to redesign the footing, contact CO.

As determined from the Geotechnical Report, excavation shall be carried to the elevation shown on the plans. If solid rock is encountered at a higher elevation than shown on the plans, the excavation should be stopped, GS contacted, and an investigation made to determine the appropriateness of revising the elevations given in the plans. If solid rock is encountered either at a higher or a lower elevation than anticipated, or if the bearing value of the supporting subsoil appears inadequate, a thorough investigation will be made. A report, along with direct recommendations to properly correct the conditions, will be sent to CO for approval.

When foundations do not require piling and excavation in clay soils is being made by mechanical methods, extreme care should be exercised so that the soil below the bottom of the foundation is not disturbed. Generally, the lower portion of the excavation should be completed by hand methods. Excavators with long teeth will loosen material to a depth of several inches and special care must be exercised so that they do not disturb the material below the bottom of the footing.

Before foundations that do not require piling are poured, the Contractor shall make sufficient tests holes, in accordance with 206.08 of the SS, showing the subsoil conditions below the bottom of the footing elevation. In addition to the nature of the subsoil encountered, the bearing value of the soil conditions can be estimated in accordance with the following table. The PEMS' estimated value of the soil should be noted. If the foundation conditions encountered are such that it appears as if a footing redesign may be required, the AE will be contacted.

Character of Soil	Safe working loads in tons per square feet
Loam, silt or quicksand	(1/2 to 1)
Soft or wet clay	(1 to 2)
Fine sand or medium clay	(2 to 4)
Hard dry clay, gravel or coarse sand	(4 to 6)
Hardpan or very dry clay	(6 to 8)
Cemented gravel	(8 to 10)
Rock (poor brick masonry)	(5 to 10)
Rock (best brick masonry	(10 to 20)
Rock (best ashlar masonry)	(20 to 30)
Very hard bedrock	(30 to 100)

5.6 COFFERDAMS AND FOUNDATION SEALS

The purpose of a cofferdam is to provide a protected area within which an abutment or a pier can be built. In general, a cofferdam is a structure consisting of steel or wooden sheeting driven into the ground to a depth below the bottom of the footing elevation and braced above the excavation to resist lateral pressure. It should be practically watertight and be capable of being dewatered.

Foundations adjacent to railroad tracks generally require cofferdams. The extent and strength required, if not set out on plans, should be discussed at the pre-construction conference with representatives of the Railroad. The Contractor's drawings for cofferdams on railroad grade separations must be approved by the Railroad before work is started. The Contractor will submit these drawings to the Railroad for approval.

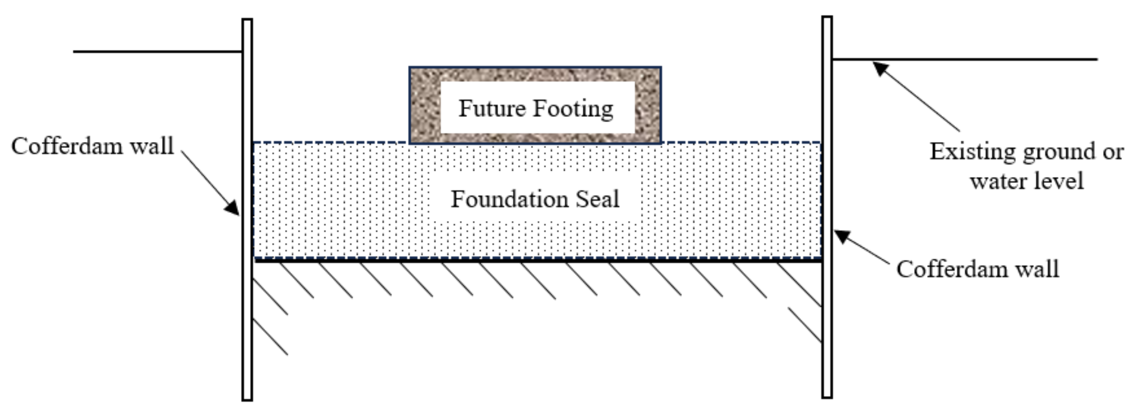
The requirement to prepare working drawings for cofferdams is the responsibility of the Contractor, in accordance with 206.09 of the SS. The working drawings must be signed and stamped by a professional engineer. The Contractor must obtain the approval of the Engineer for the proposed cofferdam plan and installation procedure prior to the start of cofferdam construction.

Foundation seals may be necessary when water within a cofferdam cannot be pumped out sufficiently for the foundation to be poured. A foundation seal should only be utilized when:

1. it is specified within the plans,
2. it is requested and approved for use, or
3. as directed.

Discuss the use of foundation seals with the AE prior to installation. Foundation seals are required to be constructed using class A concrete. If the foundation seal is added to the contract, payment will be made at a unit price per cubic yard equal to 75% of the contract price per cubic yard for class B concrete in footings.

When the seal has hardened sufficiently to withstand the hydrostatic pressure, the cofferdam can be dewatered, and the remaining structure placed in dry conditions. A basic diagram of a foundation seal is shown below.



Basic Diagram of a Foundation Seal for a Cofferdam

5.7 DRIVEN PILING
5.7.1 Introduction
Driven piling is covered in 701 of the SS and any applicable special provisions that may be included in the contract documents.

Inspection of pile driving operations is a critical part of the construction of bridge structures and other structures requiring deep foundations. For pile driving operations for permanent structures or temporary structures that will carry live traffic, full time, on-site inspection and documentation of pile driving operations is expected unless otherwise directed. The person responsible for inspecting pile driving operations must be very familiar with the piling portions of the contract documents and the instructions that apply to pile driving. They must understand how to inspect and document the work performed by the Contractor.

The Department has previously used the load factor or allowable stress design method for structures and the required capacity of a pile was referred to as the ultimate pile capacity or ultimate bearing capacity. Load resistance factor design, LRFD, is now used and the capacity of a pile is referred to as the nominal driving resistance. The terms bearing capacity and nominal driving resistance will be used interchangeably throughout these instructions.

The length of piling shown on the plans is an estimate based on soil boring data and historical information from surrounding jobs with similar soils. The Contractor is responsible for furnishing sufficient lengths of piling to obtain the required penetration and bearing or nominal driving resistance specified.

Pile driving operations are to be documented on the IC-225**,** Pile Driving Record form available on the Departments website.

5.7.2 Types of Piling
The two most common types of piling used for permanent bridge structures are steel pipe piles, also known as steel shell piles, and steel H-piles. Steel pipe piles are usually filled with concrete after being driven.

Other types of piling used are steel sheet piling, timber piling and precast, prestressed concrete piling. Steel sheet piling is typically used for temporary earth retention and for cofferdams. Timber piling is typically used for temporary bridges and other temporary work. Precast prestressed concrete piling has been installed on a few projects however, it is not normally used in Indiana.

The Contractor must provide mill test certifications for steel piling prior to driving. The mill test certifications are to be delivered to the job along with the piling and a mill sticker should be attached to each pile (see **Figure 1**). The heat number shown on the sticker should match a heat number shown on the mill test certifications.

Timber piles have a stamp in the shape of the State of Indiana hammered into their ends to indicate they have been inspected and accepted. Untreated timber piles are stamped on one end while treated timber piles are stamped on both ends.

Before use, all piling delivered to the jobsite should be inspected for damage and rejected if necessary.

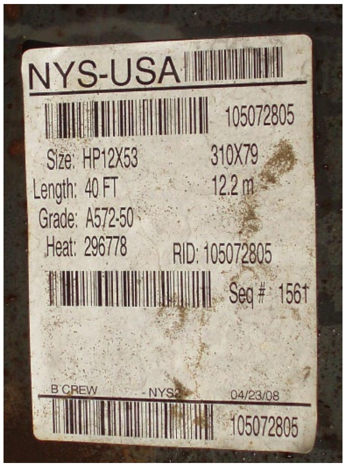


Figure 1. Pile Mill Sticker

5.7.3 Pile Driving Equipment

Piles may be driven with gravity, steam, air, diesel, hydraulic, or vibratory pile hammers. The limitations and uses for each type of hammer are described in 701.04 of the SS. The most commonly used type of hammer is the single acting diesel hammer. **Figures 2** and **3** show a sketch and photo of a single acting diesel hammer.

The typical pile hammer will include the striker plate (impact block), hammer cushion (pad), the helmet (drive head or cap), and the leads. Other components that may be used include followers, jets, collars (on timber piles only), and pile tips. Each of these components is described in detail in 701.04 of the SS.

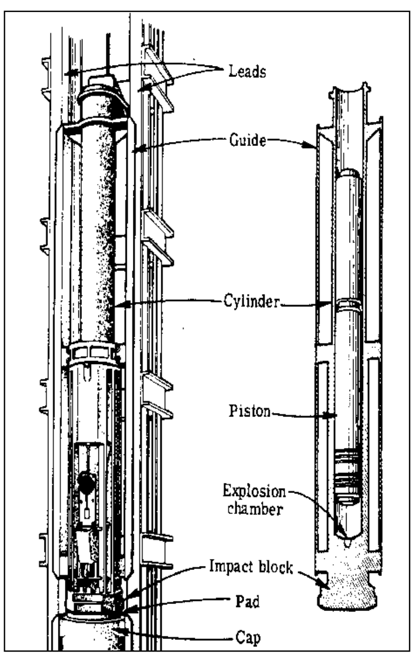


Figure 2.
Sketch of a Single Acting Diesel Hammer

Figure 3.
Photo of a Single Acting Diesel Hammer

5.7.3.1 Approval of Pile Driving Equipment

At least 15 days before pile driving begins, the Contractor must submit data on the proposed pile driving equipment to GS and the PEMS for approval. Form IC-740**,** Pile Driving Equipment Data, is used by the Contractor for the submittal and is available on the Department's website. GS will return approved forms to the Contractor and the PEMS.

GS will use either the Wave Equation Analysis Method or the Dynamic Formula Method, as described in 701.04, to determine if the proposed pile driving system is acceptable for use. The Contractor may only use an approved pile driving system. No changes to the approved system may be made without written approval from GS. When applicable, GS will also send an approved pile driving chart to the PEMS for use in determining the bearing of driven piling.

The pile hammer should have a data plate attached to it that provides the name of the hammer manufacturer, the hammer model, the hammer serial number, rated energy of the hammer (foot·pounds or Newton·meters), hammer weight (pounds or kilograms), and ram weight (pounds or kilograms). A sample data plate is shown in **Figure 4**. Check the information on this plate against that data submitted on the approved IC-740. The website www.pilebuck.com has links to several pile hammer manufacturer websites and may also be used to check pile hammer information.

Figure 4. Pile Hammer Data Plate

5.7.4 Test Piles

Test piles are driven and used to determine the required driving criteria for other piles in the same foundation or structure.

There are 3 methods used by the Department to determine the driving criteria for piling:

1. Dynamic Formula – An indicator pile is driven to the planned tip elevation or bearing, whichever occurs first. This provides an estimate of the pile capacity and the driving criteria for the remaining piling is set based on the results from the indicator pile.

2. Dynamic Pile Load Test (PDA) – A test pile is monitored during the driving operation to obtain measurements of the actual stresses in the pile and the energy imparted to the pile by the hammer. This method provides a more accurate estimate of the pile capacity than the dynamic formula.

3. Static Load Test – A pile is driven and then loaded to failure to determine the actual capacity of the pile. When used in conjunction with a PDA test, this provides the best means of estimating pile capacity and determining driving criteria.

The information obtained by a PDA test or a PDA and static load test can be used to refine the estimated pile lengths shown in the plans. In many cases the information obtained can be used to reduce the required pile length. There are additional costs associated with dynamic load and static load testing, so it should not be used on every contract. GS evaluates each site and determines which pile testing methods are appropriate.

Test piles are also typically used as production piles, except that they are longer than production piles, in accordance with 701.05 of the SS. If no test pile is indicated on the plans or contract documents, all piles must be driven to the nominal driving resistance using the dynamic formula and driving criteria provided by GS.

5.7.4.1 Indicator Test Piles

When the method for driving piling is specified as the dynamic formula, an approved pile driving chart as well as the approved IC-740, Pile and Driving Equipment Data Form will be provided to the PEMS by GS. The pile driving chart is project specific because it is tied to the hammer and job specific criteria. Nominal driving resistance or bearing can be determined from the chart by observing the hammer stroke height and the length of pile penetration per 20 blows.

If an indicator test pile is shown on the plans, it must be the first pile driven at the particular bent or pier. The pile used as the indicator test pile is usually driven in a production pile location and, if it remains in satisfactory condition, it is subsequently used as a production pile. The indicator test pile is driven to the estimated tip elevation or nominal driving resistance, whichever occurs first. The nominal driving resistance is recorded using the approved pile driving chart.

When the estimated tip elevation or nominal driving resistance is reached, pile driving is stopped and a minimum wait time for restrike, as defined in the contract, begins. The indicator test pile must not be cut off before restriking. Before restriking, it is important that the hammer is warmed up by striking a fixed object at least 20 times. The goal of the restrike is to determine if the indicator pile has gained or lost capacity due to soil setup or relaxation. The restrike ends when the pile has been struck 20 times, or when the pile has penetrated an additional 3 in., whichever occurs first.

The restrike nominal driving resistance is then determined from the supplied pile driving chart. If the nominal driving resistance observed during restrike is equal to or greater than that required on the plans, the nominal resistance obtained when the pile was first driven will be used as the criteria for production piles in that bent or pier.

If the nominal resistance observed during the restrike is less than that required on the plans, the Contractor must continue to drive the pile until the required nominal resistance is obtained. The restrike procedure is then repeated. If the required nominal driving resistance observed during the second restrike is still less than that required on the plans, pile driving operations must stop and GS must be contacted for further guidance. This process is repeated for each indicator test pile shown indicated within the plans.

5.7.4.2 Dynamic Load Test Piles

When the method for driving piling is specified as the dynamic pile load test (PDA testing), then measurements will be taken of acceleration and strain near the pile head as it is driven in order to evaluate the performance of the pile driving system, to determine pile integrity, to calculate pile installation stresses, and to estimate static pile capacity.

A PDA test is typically performed on the first pile that is driven on the contract. Additional tests may also be required for the contract. A pile used as a dynamic test pile is usually driven in a production pile location and, if it remains in satisfactory condition, it is subsequently used as a production pile. Typically, GS will arrange for a pile driving analysis consultant to perform much of the testing and analysis required for a PDA test. The PDA testing equipment is attached to the pile by either the PDA consultant or the Contractor, either before or after the pile is placed into the leads. Examples of the PDA equipment attached to a pile and the PDA data collector are shown in **Figures 5** and **6**.

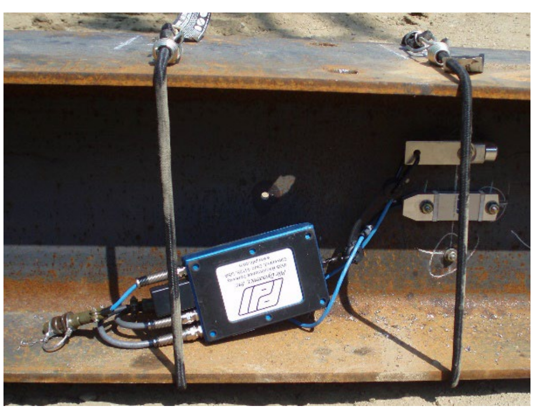


Figure 5. PDA Gages attached to Pile

Figure 6. PDA Data Collector

The pile used in the dynamic pile load test is driven until the PDA consultant directs the Contractor to stop driving. The pile must not be cut off at this time. The pile is then restruck after waiting the minimum time defined in the contract. After the restrike is completed, the PDA consultant will provide the Contractor and the PEMS with the final driving criteria to be used, usually within two business days. After completion of the initial PDA test, the PDA consultant will provide preliminary driving criteria and the Contractor may drive production piling before the final driving criteria has been received. However, any piles driven during this time are at the Contractor's risk and may need to be re-driven if the final driving criteria are not met. A good example of when this may occur is if the piles are deep enough that they will need to be spliced.

The Contractor could drive the bottom sections before the final driving criteria have been received.

5.7.4.3 Static Pile Load Test

When the method for driving piling is specified in the contract as a static load test, then 3 types of tests will be performed on the pile: axial compression, axial tension, and lateral load.

A static pile load test is performed on a pile in a location indicated on the plans. This type of test is only occasionally specified in contracts and is done prior to driving any production piling. For the static pile load test, the Contractor must design and submit for approval a reaction frame capable of placing the required load on the test pile. Some example setups are shown in the referenced ASTM D1143; a copy of which may be obtained from the DMTE.

A PDA consultant will direct and analyze the loading of the static test pile. Before the static pile load test begins, the PDA consultant will analyze the static test pile as it is driven by means of a dynamic pile load test as described previously.

The pile used for the static load test is not able to be subsequently used as a production pile as it is loaded to failure as part of the test. However, up to two of the piles used in the reaction frame may subsequently be driven and used as production piling, provided they remain in satisfactory condition.

5.7.5 Pilot Holes

Pilot holes, if required in the contract, are dug prior to driving piling. There are three types of pilot holes: prebored, predrilled, and cored. Each is further described below.

5.7.5.1 Prebored Holes

Prebored holes are typically specified when difficult driving conditions are anticipated. Prebored holes are slightly smaller than the diameter or diagonal of the pile being driven, stopped just short of the pile tip elevation, and are paid by the linear foot.

5.7.5.2 Predrilled Holes

Predrilled holes are typically used to reduce or eliminate downdrag forces from acting on the piling. They are also used when driving piling through newly constructed embankments.

Predrilled holes are slightly larger than the greatest dimension of the pile being driven cross section. The cost of predrilled holes is included in the cost of the piling items unless specified otherwise in the contract.

5.7.5.3 Cored Holes in Rock

Cored holes in rock are performed to accommodate pile placement through rock. The holes should be cored to the diameter indicated within the plans and are paid by the linear foot.

5.7.6 Production Piles

5.7.6.1 Layout and Preparation

Once the bottom of the footing is prepared, the location of the piles is laid out. Piling is required to be driven in a certain order within a foundation as described in 701.09. This specific driving order is necessary to minimize disturbance and heaving of previously installed piling.

In some instances, water infiltration may be a problem, and a cofferdam and possibly a foundation seal may be required in order to provide a relatively dry work area. **Figure 7** shows a cofferdam with the locations of piles marked.

Figure 7. Pile Locations Marked at the Bottom of Footing

Prior to driving, the Contractor must mark the piles in 1 ft increments. This allows the HT and the Contractor to determine the approximate length of penetration and to determine the penetration per given number of blows while driving. **Figure 8** shows an H-pile marked in 1 ft increments.

The ground can be used as a reference for measuring penetration, but there are also other options. Using the ground can be difficult and inaccurate if the surrounding soil heaves as the pile is driven. The pile gate may also be lowered and obstruct the view of the pile. A better way to measure penetration is to use a fixed point on the leads as a reference.

One thing to be aware of when using a mark on the leads is that the leads tend to “jump around” as the pile is driven if they are not toed firmly in the ground. Another method that is commonly used to measure penetration is to drive a lath a few inches away from the base of the pile being driven. The lath can be pushed toward the pile to the point where it is actually touching the pile as it penetrates. This provides for a solid reference to measure penetration. The inspector should have a good idea how far the production piles will be driven based on data obtained from the test pile.

Figure 8. Steel H-Pile Marked in 1 ft Increments

5.7.6.2 Alignment

Piles are driven either vertically plumb or battered to a specified angle. The batter angle will be shown on the plans and is typically a rate of 1 horizontal to 4 vertical. Steel H-piling must be oriented as shown on the plans since these piles have a weak axis and a strong axis and are designed with a specific orientation based on those axes. Steel pipe piling and timber piling may be driven without consideration given to their orientation. Tolerances are provided in the SS for pile alignment.

5.7.6.3 Pile Tips

Generally, pipe piles are fitted with an end plate or a conical tip welded to the bottom. H-piles sometimes require pile shoe tips. Conical tips and pile shoe tips are paid per each. End plates are not paid separately. Check to verify that the pile shoe tips provided meet the SS. **Figures 9** and **10** show examples of H-pile shoe tips.

Figure 9.
Bottom of H-Pile Shoe Tip

Figure 10.
Top (Connection Side) of H-Pile Shoe Tip

5.7.6.4 Driving

Pile alignment must be checked by the Contractor during the first several feet of driving so any necessary corrections can be made. **Figure 11** shows the Contractor checking of the vertical alignment with a four-foot level.

Figure 11. Contractor Checking Pile Alignment

Piling must be driven until the required bearing is obtained, in accordance with the driving criteria. As indicated within the plans, all piling must be driven to the minimum tip elevation or to a minimum penetration of 10 ft below the bottom of footing elevation. If driving conditions are encountered that make this difficult, the PEMS should contact GS for guidance.

Single acting diesel hammers are equipped with graduated rings or grooves on the ram in order to visually determine hammer stroke. **Figure 12** shows the piston extending from the top of the hammer. A dark ring is on the piston for reference. Communicate with the Contractor before driving to make measurements and understand the reference rings on the ram while the pile hammer is still on the ground.

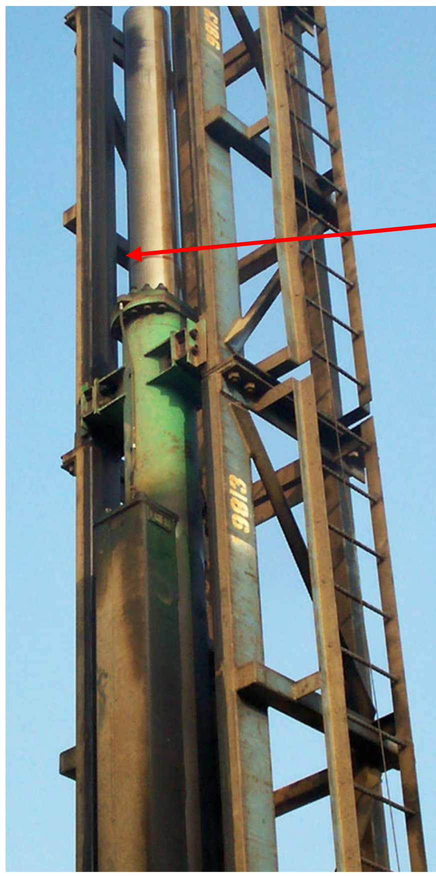


Figure 12. Piston Extending from the Top of the Hammer

Beginning at least 10 ft above the estimated pile tip elevation, the blow counts per each foot of penetration are recorded on the IC-225. Driving can be stopped once the pile has reached both the minimum tip elevation and the blow count for the required nominal resistance.

5.7.6.5 Practical Refusal

On occasion, the pile will reach practical refusal before the minimum tip elevation can be reached. Practical refusal is defined as a minimum of 20 blows per inch of penetration. Driving must be stopped when a pile reaches practical refusal in order to avoid damaging the pile.

5.7.6.6 Soil Heave

Soil heave occurs when driving a pile causes upward movement in the surrounding soil. Some soil types, particularly loose granular soils, are more susceptible to soil heave. Soil heave can cause upward movement in previously driven piles and can also reduce the bearing capacity of those piles. The Contractor is required to take elevation readings on the piling to determine if soil heave is occurring.

Any pile that has heaved more than 1/4 inch must be re-driven to the required bearing and tip elevation.

The geotechnical report can be referenced to determine if soil heave is anticipated for a given foundation.

5.7.6.7 Splices and Cut-offs

Depending on the depth of driving, piling may need to be spliced. The Standard Drawings show approved pile splice methods. All welds must be done in accordance with AWS D1.5 and welders must have a valid AWS welding certification. The welder must knock the slag off of the weld so that it may be visually inspected, but ultimately the Contractor is responsible if the splice fails.

Piling should not be cut off, unless necessary to drive other piling in the vicinity, until any restrike required has been successfully performed and the PEMS is satisfied that the piles have not heaved or that any heaving has been taken care of by re-seating the pile. **Figure 13** shows the Contractor cutting off the pile to the required elevation.

Figure 13. Pile being cut off at the plan elevation

Once all of the piling in a footing has been cut off to the plan elevation, as shown in **Figure 14**, the next step is to form up the footing, place the reinforcing bars, and place the concrete.

Figure 14. Piles cut-off at plan elevation

5.7.7 Inspection Procedures

The PEMS must ensure that an HT is on-site during all pile driving operations and that the HT understands the instructions and the specifications that cover the type of piling operation being performed.

The following is a summary of the required inspection procedures.

5.7.7.1 Preparation

Check that the materials to be used in the operation are approved and that any required certifications have been submitted.

Obtain a copy of the approved Pile and Driving Equipment Data form, IC-740 and check that the pile hammer and appurtenances are the same as on the approved form.

Obtain a copy of the approved pile driving criteria for determination of bearing values.

For piling being controlled by PDA or static test results, the driving criteria will specify the number of blows per foot for a given length of piling and a given stroke of the hammer. The PDA driving criteria will be provided by the PDA consultant.

For piling being controlled by either indicator test piles or strictly by the dynamic formula, GS will provide the driving criteria. Typically, the criteria will specify the maximum penetration required for 20 blows at a given hammer stroke to obtain a given bearing value.

Prepare a copy of the IC-225 for the specific structure and foundation where the piling will be driven. A separate IC-225 must be completed for each pile in a foundation.

5.7.7.2 Test Pile Inspection

Ensure that the correct type and size of piling is being placed. Check the orientation of the pile as required. Ensure that the piling has been marked in 1 foot increments for its entire length.

If PDA testing is being done, discuss with the PDA consultant how the operation will proceed and what their responsibilities and the HT's responsibilities are.

For indicator piles, PDA test piles and PDA driving performed as part of a static load test, record the number of hammer blows per each foot for the entire length of pile driven. Record the bearing values, the total length driven, penetration depth, and other information as required on the IC-225.

During the driving operation, ensure that the Contractor checks for proper alignment of the pile and makes necessary adjustments.

As the test pile approaches the required minimum tip elevation or bearing, record the number of blows per inch of penetration. During the test pile restrike, record the number of blows per inch for either 3 inches or 20 blows, whichever occurs first.

Require the Contractor to obtain elevations to check for soil heave as necessary and record the data on the IC-225.

5.7.7.3 Production Pile Inspection

Ensure that the correct type and size of piling is being placed. Check the orientation of the pile as required. Ensure that the piling has been marked in 1 foot increments for its entire length. Obtain the measurement for each section of piling before it is placed in the leads and record the measurement to the nearest 0.1 ft.

Determine the approximate length of each pile to be driven. This approximation can be made from the lengths shown in the plans or from test pile results.

Observe the pile driving operation and when there is at least 10 ft of the pile remaining to be driven, based on the approximate length previously determined. Record the number of blows per foot of penetration on the IC-225. Note that in some cases, the number of blows per foot of penetration for the entire length of the pile may be required to be recorded.

During the driving operation, ensure that the Contractor checks for proper alignment of the pile and makes necessary adjustments.

If a minimum tip elevation is shown in the plans, ensure that the pile has been driven to at least this minimum elevation. If a minimum tip elevation is not given, ensure that the pile is driven at least 10 ft below the bottom of footing elevation.

Direct the Contractor to stop driving once the pile has obtained both the minimum bearing value, based on the driving criteria, and the minimum tip elevation.

Require the Contractor to obtain elevations to check for soil heave as necessary and record the data on the IC-225.

5.7.7.4 Splices and Cut-offs

Ensure that welding is performed by an AWS certified welder.

Observe splicing and cut-off operations to obtain lengths of piling added or removed. Record the information on the IC-225 in order to obtain the final pay length for each pile.

5.7.8 Inspector's Documentation

Note any driving problems, such as misaligned or damaged piles, unexpected length of piling driven, inability to obtain minimum bearing, practical refusal prior to minimum tip elevation, soil heave or any other unanticipated conditions on the IC-225. Complete all required information on the IC-225.

5.7.9 Measurement and Payment

Measurement and payment for driven piling and associated items of work must be performed in accordance with the SS.

For a test pile, whether it remains as a production pile or not, the cost to supply and drive the pile is paid by the linear foot of piling, regardless of the pile type. The cost of the portion of the testing work the Contractor is responsible for is paid for by each for the type of test performed. When a restrike of a test pile is required, the cost of the restrike work is paid for by each pile restruck. **Example 1** below is provided to clarify measurement and payment for a test pile.

Example 1

A dynamic pile load test is required for H-piling on the first pile driven in a foundation. Pile shoe tips are also specified. The estimated length of each pile is 95 ft with a minimum tip elevation of 624.00.

The test pile is driven and accepted in accordance with the SS. However, the required bearing is not achieved until the tip elevation reaches 618.00. In order to reach this length, it is necessary to splice on a second section of H-pile. 120 ft total of H-pile are placed in the leads. The pile is driven in a location within the foundation for a planned production pile. The final cut-off length of piling totals 18.7 ft. Pile driving records, including the required restrike, are kept on an IC-225. The following items are the final measurements and pay items for this test pile:

- *Dynamic Pile Load Test – 1 Each*
- *Test Pile, Dynamic, HP 14 x 84, Production – 101.3 ft (120.0 – 18.7)*
- *Test Pile, Dynamic, Restrike – 1 Each*

- *Pile Shoe, HP 14 x 84, Steel H – 1 Each*

5.8 FILL AROUND STRUCTURE

The use of unsatisfactory material and the improper placing of fill material at the end of structures will produce rough riding surfaces and may cause damage to the structure. The PEMS must provide inspection at the time of backfilling and while the approaches to the structure are being constructed to help confirm proper placement, lift thickness, and compaction. Each structure presents a different set of problems for obtaining properly compacted embankments and backfill due to varying soil types, varying moisture content, topography changes, and other variables. It is the responsibility of the PEMS to see that all fills are placed and compacted to proper density to help remove the potential for further settlement.

Abutment type structures and arch structures usually require that structure backfill be used for backfilling and for fill around the structure. The PEMS must make certain that the material conforms to and is placed in accordance with the SS.

No fill should be placed around the structure until the walls have been inspected and approved. Fill must then be placed to the required finished grade in front of the abutments, wings. Retaining walls must be constructed simultaneously with the fill being placed behind them.

In filling over arches, great care must be taken to see that the fill is placed symmetrically from haunches to crown so that the loading on the arch is brought up and placed uniformly so to not induce unbalanced loading on any part of the structure, in accordance with the plan documents and the SS.

The approach embankment at pile end bents of “spill-through” type structures may be constructed before or after end bent piles are driven. If construction of fill is made before piles are driven special attention should be given to assure the maximum compaction of fill. Coring of holes to receive the piles should be carefully located and drilled to approximately the elevation of the original ground. Any voids around the piling after it is driven should be filled with fine granular material.

The PEMS must give special attention to intermediate bents that fall within the limits of the spill-through slope. Heavy earth moving and compaction equipment will cause sufficient pressures on bents of structures that may cause tipping of the bent. The longitudinal alignment of such bents must be checked as spill-through slopes are constructed.

5.9 FALSEWORK

The Contractor must prepare working drawings specific to the contract which are signed by a Professional Engineer for any falsework including stay in place (SIP) deck forms, cofferdams, coping falsework, deck falsework, superstructure falsework for reinforced concrete slabs, and designs for temporary bridge structures on runarounds. These should be submitted to the PEMS for distribution to the appropriate reviewers.

Questions about review of shop drawings should be addressed to the AE. The Department's approval of shop drawings in no manner relieves the Contractor of the responsibility to construct falsework to support the loading to line and grade.

Several bearing joints of timber upon timber will result as falsework is constructed. These joints will crush together as they are loaded. Anticipated timber crush should be taken into consideration when setting elevations for falsework. In addition, the falsework grades should be set to provide for concrete dead load deflection as given in the plans.

The PEMS must perform a general check of the falsework, as it is being placed, to determine that it is being placed in substantial compliance with the approved falsework drawings.

A general check should include checking falsework bents, falsework piling bearing capacity, size and spacing of materials, connections and joints, and the general fit of the work. In many cases, it may not be possible to perform a complete and detailed check of the falsework. However, the PEMS should instruct the Contractor to correct any observed deviations from the approved falsework plan and to comply with all safety requirements.

Stay-in-Place (SIP) Forms for concrete bridge decks can cause bridge deck cracking when not properly installed. SIP forms must be checked to ensure the vertical leg of the support angle does not extend above the top of the SIP form (pan) line.

If the vertical leg of the support angle does protrude above the SIP deck line, the Contractor should be notified to take corrective action to rectify the problem.

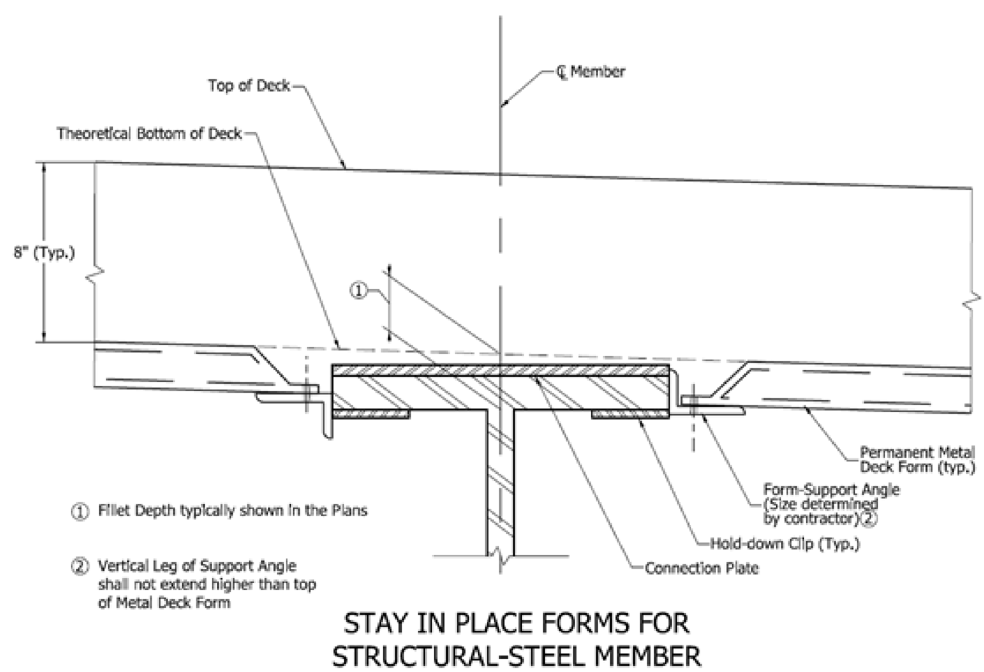
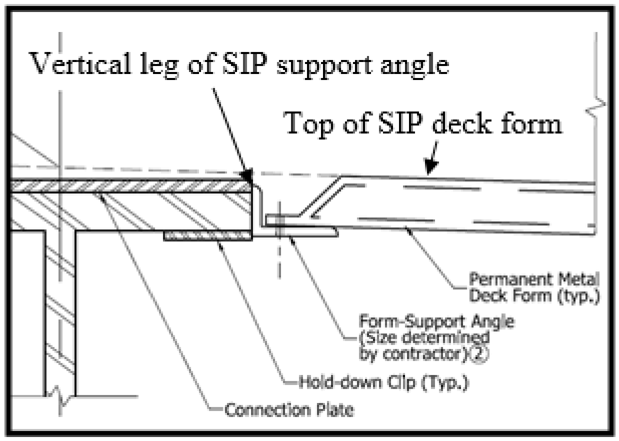


Figure 15a. SIP Form attachement to steel members



Inset of **Figure 15a** indicates a correct SIP angle support placement in relation to the top of the SIP deck form line. The vertical leg of the support angle does not protrude above the SIP deck form line.

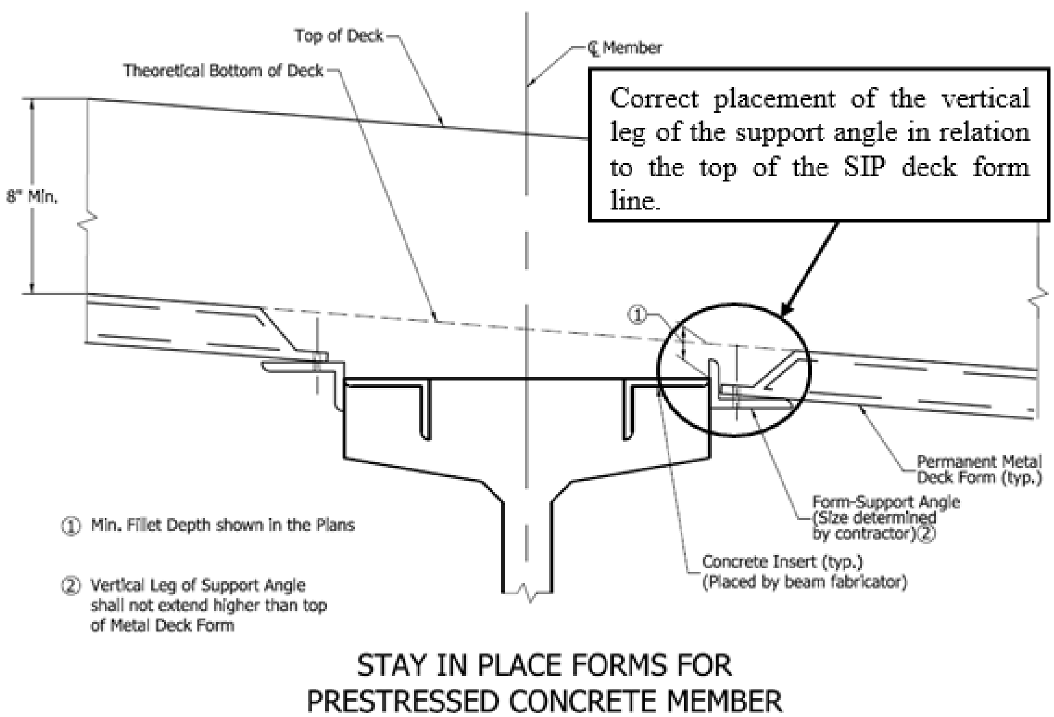


Figure 15. SIP Form attachement to concrete members

If a maximum soil pressure is specified for mudsills on which falsework bents are to be placed, a subsoil investigation must be performed as outlined in Section 5 of these instructions. If a maximum settlement of these mudsills is specified, CO must be notified prior to mudsill placement.

5.10 FORMS FOR CONCRETE

Forms must be checked for proper dimensions, plumbness or required batter, alignment, bracing, tightness, and for the required form lining on exposed surfaces. Checking the forms by the PEMS should be performed progressively as they are built and not delayed until form work has been completed. Copings, curb lines, and handrail or parapet wall forms should be very carefully checked for alignment and for smoothness in a vertical plane. Joints in sectional forms should be smooth and rigid to prevent irregularities in exposed surfaces.

Vertical and horizontal alignment of curbs, copings, and other exposed lines should be carefully checked during the placing of concrete. Any improper alignment must be corrected before completion of pour.

Surface smoothness and alignment of the finished concrete should be achieved by proper attention to form work.

Wall forms must be thoroughly and securely tied and braced to ensure against bulging surfaces and poor alignment.

Forms should be treated with form release agent so the agent does not come in contact with the reinforcing steel. If form lumber will be in close proximity with reinforcing steel already placed, the lumber should be pretreated with the releasing agent before it is placed.

No welding of attachments of any kind for form supports will be permitted on flanges of steel beams or girders in areas where beam flanges are designed to carry tensile stress. On simple spans, the upper flange will not be in tension. On continuous steel spans, the top flange is designed for tension over all piers to the points of contraflexure. Welding will not be permitted within this area. Due to variations in combinations of span lengths, it is impossible to establish a “rule of thumb” method of establishing the location of tensile stress in the flange. The PEMS should determine, as early as possible, the proposed method of attaching supporting formwork to the structural steel. If welding of attachments is proposed, the Contractor should request, through the PEMS, for a determination of the limits where welding will not be permitted on the flanges. No form construction requiring welding of attachments to beams shall be permitted at any location on the structural steel until the restricted limits are established.

The gutter line at the base of a curb is the location that gets the full force of drainage and de-icing solutions causing potential disintegration of the concrete. Every effort should be made preserve the homogeneous mixture of the concrete at this location when removing the curb board supports. The curb board supports must be designed of metal so that their removal will cause no damage to the concrete. Their removal must be accomplished and any holes carefully and fully patched before the concrete has set. Wooden legs are not permitted. The removal of the curb board should be made as soon as possible after the concrete has set sufficiently to hold its position. This should be performed so that the gutter line may be given a smooth grade and any irregularities in the face or top of the curb can be aligned and smoothed.

5.11 GRADE CONTROLS FOR BRIDGE DECKS

Control grades are required along each beam line to establish the floor bottom elevations, top and bottom of coping elevations, and the finished floor grade at the beam lines. If screed grades at the beam lines and the coping have not been provided in the plans, the PEMS should obtain the floor screed grades by contacting the Designer of Record. These grades will have been computed for dead load deflection.

As soon as the beams or girders are set in their final positions, elevations should be taken along the beam lines at the screed locations. These elevations subtracted from the computed screed grades produce the dimension the floor grade or coping must be set above the point on the beam.

On continuous steel beam or girder units, all the elevations for the entire length of the continuous portion of the bridge must be taken before any concrete floor is poured. All screeds and copings are thereafter set to the dimensions computed. Note that the elevations of the beams and top of screeds at any point will vary as each unit of floor is poured and will not reach their final and proper grade elevation until the entire floor is poured. Refer to instructions on the plans for continuous steel beam or girder structures.

If the bridge seats (bearing areas for girders or steel shoes) have been constructed to the correct elevation and the steel properly fabricated, this screed data will produce a smooth floor of correct thickness.

Because floors on steel beams and girder bridges are generally 8 in. in thickness, it is important that bridge seats (bearing areas) be poured to the correct elevation. In practice, a tolerance of plus or minus 1/4 in. in these bridge seat elevations will be satisfactory. Errors in elevations in excess of this tolerance must be corrected. The PEMS should discuss the method of correction with the AE.

Elevations for longitudinal screeds on concrete bridges (slabs, girders, rigid frames, simple spans or continuous spans) are computed in the same manner as described above. However, since this type of bridge is supported on falsework, screed elevations are generally set by direct leveling.

There is always some deflection in each span of the supporting falsework and generally a small amount of settlement (timber take-up in the horizontal joints of the various members) at each falsework bent. Generally, some consideration and allowance must be made for such deflection in the falsework, in forming, and in setting the screeds. Since the choice of design of falsework is the responsibility of the Contractor, no definite rule as to the exact amount of deflection can be established.

The amount of settlement, or timber take-up, at the bents varies with the number of horizontal joints, the grade of timber, general workmanship, and the intensity of the load at the bent. In practice, bent settlement (timber take-up) from 1/8 in. (lightly loaded bents) to 1/4 in. (heavily loaded bents) should be allowed.

In setting longitudinal screed elevations by direct leveling, control points at 8 to 10 ft centers are usually sufficient. For concrete spans which vary from 20 ft to 60 ft, three to five control elevations are usually sufficient in each span. The controlling elevations are set at each bearing point, at the center of span, and at quarter points of the span. Other points are obtained by stretching a chalk-line or wire over the control points and working out a smooth curved screed line. In many cases it is advantageous to select control points over the falsework bents.

The PEMS should check each screed or exposed line by carefully sighting directly along the line several times during the placing of the concrete. Any appreciable variation from the smooth line can be seen and corrected. In order to check deflection in falsework during the pouring of any span, the Contractor should take rod readings on the control points just before starting the pour and make frequent checks of each falsework bent after it has received its full load of concrete before the final pass of the strike-off over that bent.

If deflection or settlement is in excess of that originally allowed, the screed should be raised as necessary to provide a smooth riding floor. However, care must be taken not to increase the floor thickness more than 1/2 in. as this will increase the dead load on the structure. This additional concrete could potentially reducing the life of the structure and the ability to add a future wearing course.

5.12 PLACING REINFORCING STEEL

The protection of materials to be incorporated in the contract is a fundamentally good construction practice. It is important to insist on compliance with the SS in order to maintain clean materials that will perform their proper function. It is necessary that special emphasis be placed on inspection and engineering control and to require the Contractor to protect reinforcing steel in accordance with the SS. This process involves keeping reinforcing steel above the surface of the ground on platforms, skids, or other supports.

Reinforcing steel must also be covered to protect against moisture and other detrimental effects. Supports for the reinforcing bars should be placed at intervals so that long bars will not sag onto the ground at the ends and short bars are not permitted to fall through the supports to the ground. As the steel is used, the PEMS must require that the reinforcing steel portions remaining for future work are not thrown off the supports. These remaining portions must be restacked and covered.

Careful handling of epoxy coated bars is required in order to reduce the amount of nicking and scuffing of these bars.

Reinforcing steel is called out within the plans using a system of numbers. The Standard Drawings indicate the numbering system utilized. In general, straight reinforcing bars are identified using number designations based on the diameter of the bar itself. The industry standard for straight bar designations is based approximately on increasing bar diameters in 1/8 in. increments. The chart below indicates standard bar designations, diameters, and weight per foot.

Standard Reinforcing Bar Designations and Physical Characteristics		
Bar Size Designation	Bar Diameter (inches)	Bar Weight (lbs/ft)
#3	0.375	0.376
#4	0.500	0.668
#5	0.625	1.043
#6	0.750	1.502
#7	0.875	2.044
#8	1.000	2.670
#9	1.128	3.400
#10	1.270	4.303
#11	1.410	5.313
#14	1.693	7.650
#18	2.257	13.600

The Standard Drawings also include information concerning the designation of bent reinforcing bars. Bent bars are given a numeric bar mark, for example “588”. The last two digits, in this case “88”, designate the bar mark indicated within the plans. This bar mark is specific to the bend pattern of the bar. The digits preceding the last two digits indicate the size of the bar, in this case “5” indicates a number 5 bar size should be used. Reinforcing steel used for epoxy coated bars generally meets either ASTM A615 or ASTM A706. These may be identified by mill marks of ”S” or ”W”, respectively. Bars meeting both specifications are marked with ”S” and ”W”.

Reinforcing steel shall be placed in accordance with plans and shall be in place before any concrete is poured. Vertical bars projecting from footings shall be located and placed with extreme care. They must be held securely in position by fastening them to a supporting frame while concrete is being placed. Frequent inspection must be made during the concrete pour to confirm that bars are not displaced.

In all cases, reinforcing bars shall be held securely in place and supported properly in accordance with the SS. Care shall be taken to confirm that no steel comes in contact with the forms. The “Placing and Fastening” provisions of the SS must be followed. In case there is a delay in placing concrete, an inspection of the reinforcing steel should be made. Clean the reinforcement as needed.

It is essential to maintain the positioning of reinforcing steel in the deck for compliance with the plans. The PEMS must check the clearance between the top mat of reinforcing steel and the finished grade to verify that the steel will have the specified coverage of concrete. This can be accomplished by passing the finishing machine along the screeds and directly measuring the clearance from the bottom of the strike off roller to the steel. This clearance must be checked and the measurements recorded. An acceptable minimum number of transverse locations would include the centerline of the structure, lane lines, edge lines, and gutter lines. These transverse locations must be checked every 10 to 15 ft longitudinally. When the top and bottom mats of steel are not tied together with spacing bars, it will be necessary to tie the top mat to the forms to prevent longitudinal and lateral movement of the steel.

As soon as the deck concrete has been placed and struck off and while the concrete is still in a plastic state, an adequate number of measurements (suggested at every third screen grade location) shall be taken showing the actual depth of concrete over the reinforcing steel. Record these measurements. Any movement or upward lift of the reinforcing steel will cause the reinforcing to be too close to the surface. Immediate steps must be taken by the Contractor to provide corrective action which may include additional tie-downs to the forms.

5.13 MIXING CONCRETE

One of the first tasks of the PEMS prior to any bridge pour is to check the concrete mixture information for SS conformance. Components of the mix must be checked for conformance to the Contractor's submitted mix design as well as adherence to 702 of the SS.

Tests must be made during each pour to determine the slump, air content, and yield of the concrete mix as per the Frequency of Sampling and Testing Manual. The manual is available on the Department's Division of Materials and Tests website at: https://www.in.gov/indot/doing-business-with-indot/contractorsconstruction/division-of-materials-and-tests/. As soon as practical, at least one water/cement ratio test is required to be performed on concrete used for the superstructure or for silica fume modified overlay concrete. Test results must be within the limits indicated within the SS.

The PEMS must perform continual monitoring of the transit mix operations. The SS require that the mixing speed of truck mixers shall be in accordance with the manufacturer's rating, and that the number of revolutions of the drum at mixing speed shall be not less than 70 nor more than 100. When transit mix trucks are used, the following items must be checked:

1. Manufacturer's rating plates are legible and in place
2. Revolution counters are attached and in operating condition
3. Mixing speed and number of revolutions comply with the SS and manufacturer's recommendations
4. Trucks are being used at or below rated capacity
5. Capacity of water storage, old concrete build-up, and general condition of equipment.

5.14 PLACING CONCRETE

The SS direct that concrete shall be placed so there is no more than 5 ft of free fall within the forms. This requirement is to help prevent segregation of the concrete mix. Particular attention must be given to methods of placing the concrete in the forms to avoid segregation.

On the first load of concrete, determination of the air content must be made. The frequency schedule and requirements for the concrete tests must be reviewed thoroughly before pouring begins. The Frequency of Sampling and Testing Manual should be used to help determine the testing requirements.

When belt conveyors or pumps are used, sampling for air, slump, and yield will be performed at the discharge area of the pump or conveyor. In each case, material shall be permitted to drop to the forms where it will then be shoveled into the testing apparatus. As a matter of caution, concrete pumps work under extreme hydraulic pressure. Therefore, making of beams and other activities must be performed at a safe distance from these pieces of equipment. Pumping of concrete shall be in accordance with 702 of the SS which also requires the Contractor to submit a description of its pumping procedures at least 24 hours before concrete placement.

The preparation and the curing of test beams must receive close attention so that results from test beam breaks will be representative of the pour.

In some cases, it may be impossible to remove all water prior to placing footing concrete. Placing concrete into still water up to 6 in. deep may be allowed. In such cases, the concrete placement operation should start at one end of the form and continue to progress toward the opposite side of the form until the surface of the concrete is well above the surface of the water. The concrete should be allowed to work itself forward and displace the water with as little help as possible. The concrete should never be dragged through or shoveled into the water. Sufficient pumping should be maintained to keep the surface of the water at the desired depth. The depositing of concrete in moving water should never be allowed. The placing of concrete in more than 6 in. of still water should be performed only with special permission. The AE should be contacted for questions concerning placing concrete into water.

5.15 FINISHING CONCRETE SURFACES

All concrete surfaces must be finished in accordance with 702 of the SS.

The PEMS must give special attention to the construction and finishing of bearing areas of bridge seats and sliding joints. Bearing areas must be finished level in a true plane (unless otherwise provided) and to the elevation shown on plans. The areas between bearing areas of the bridge seats or the tops of piers shall be constructed with a small slope or crown to provide drainage.

5.16 FINISHING BRIDGE DECKS

It is the responsibility of the Department’s field staff to ensure that bridge deck construction, including the workmanship and materials, is performed in accordance with the contract documents and 704 of the SS.

Items of importance are:

1. Placing and positioning of reinforcing steel, including specified concrete coverage over the reinforcement.

2. Consistency of air content and slump within the concrete mix.

3. Adequate and immediate curing.

4. Independently supported runways to prevent movement of the steel.

5. Addition of surface water during finishing only when necessary, and in accordance with SS.

When possible, the PEMS should be present for all or part of the deck pour, preferably at the start of the pour.

To help alleviate the plastic cracking, which follows a pattern directly over the reinforcing steel, it will be necessary for the Contractor to provide walk boards along adjacent sides to the bulkheads so that during the placing of concrete, pedestrian traffic will not be stepping on and moving the reinforcing steel which extends through the bulkheads. These walk boards shall be constructed to rest on the forms and not on the reinforcing steel.

Usually, some hand finishing on a bridge deck is required to produce a smooth riding surface and to achieve proper profile grade and transverse crown section. However, excessive hand finishing tends to reduce the air content at the surface of air-entrained concrete. The loss of air-entraining leads to spalling, cracking, and other undesirable faults that affect the life of the deck.

The PEMS will make careful observation during the placing of the concrete to ensure that dehydration, brought on by atmospheric conditions, is not causing stress planes or cracks in the fresh concrete.

The concrete surface will be checked with a 10 ft straightedge immediately after the finishing is completed. Particular attention must be given to straightedging at transverse bulkheads and expansion joints.

Required curing shall be provided immediately after the finishing operation.

After a minimum curing period of the bridge deck or a section thereof, the PEMS will straightedge the previous pour, paying particular attention for irregularities at transverse bulkheads and expansion joints. Any irregularities not within the limits of the SS shall be corrected. Straightedging will be performed with a 16 ft steel straightedge supplied and operated by the Contractor.

When deck sealing is called for on the plans, the concrete surface shall be completely cleaned, dry, and dust free prior to the sealer application. A non-epoxy PCC sealer is the only sealer material allowed to be placed on prepared PCC surfaces.

5.17 FINISHING CONSTRUCTION JOINTS

Where construction joints are shown on the plans or the Engineer authorizes their location, they will be placed in accordance with 702 of the SS.

Construction joints designated on the plans for structures are located with consideration for the relief of shrinkage stresses in the concrete and the workability for finishing operations. Construction joints located for reasons of design stresses are essential and must be constructed in accordance with the plans. Certain construction joints may be marked as “Optional.” The placement of these joints is optional to the Contractor with consideration for the capability and capacity of the Contractor to place and finish the concrete in accordance with the SS. All joints not marked as optional must be placed as shown, unless approval is obtained for relocating or eliminating these joints.

The top edges of a longitudinal construction joint on bridge decks are not to be rounded with an edging tool. These joints should be carefully worked to produce, as nearly as possible, a watertight joint.

Horizontal construction joints surfaces in piers, abutments, wingwalls, arch skew backs, and similar joints should be cleaned of all cement residue and thoroughly wetted before placing new concrete on the existing surface.

5.18 CURING CONCRETE

Proper curing time is essential to produce acceptable strength and durability in concrete. Attention should be given to obtain curing in accordance with 702 of the SS.

Test beams used for controlling the application of loads on concrete must be cured in the same manner, and for the same time as the concrete it represents.

5.19 CONCRETING IN COLD WEATHER

The provisions of 702 of the SS should be followed for concreting in cold weather. If the Contractor elects to use high-early strength concrete instead of the specified mixture, the heating and curing period is controlled by test beams. The heating period will be extended if, for any reason, the required temperature is not maintained. If test beams control field operations, the discontinuance of heating and curing can be permitted when the modulus of rupture for concrete reaches the value as provided within 702 of the SS.

Details as to housing and heating methods for concrete placed in cold weather must be discussed in advance of the operation with the Contractor. Concrete operations should not be permitted until suitable means for housing and heating have been provided. If a space heater with a blower is used, the extreme hot air should not be blown directly onto the forms or green concrete. A baffle to spread the hot air should be used. Suitable provisions should be made to prevent premature drying of concrete during the curing period. Sudden changes in temperature are common in Indiana. It is good practice for the Contractor to be prepared for severe conditions.

5.20 BRIDGE EXPANSION JOINTS

Bridge expansion joints must be constructed in a true plane and not warped. The location of an expansion joint should be carefully checked so no coping or other projection is built in a location where it could be cracked or broken off by subsequent movement of the structure.

The PEMS should carefully check the surface between the bridge deck and the adjoining bridge approach pavement to see that the transition is properly formed and smooth once poured.

Many structures are designed with integral or semi-integral end bents. These type structures do not have expansion joints. The expansion in these structures is taken up in the rotation of the end bents and the movement of the approach slabs.

The joint manufacturer must prepare and submit working drawings. Those drawings are required to include details of the assembly, installation instructions, manufacturer’s specifications for joint materials, a statement of compatibility of the joint material and the substrate, and joint setting data.

5.20.1 Pre-Compressed Foam Joint

When use of a pre-compressed foam joint, PCF, is specified, the existing joint and the adjacent concrete must be removed to the limits indicated on the plans. Additional concrete may need to be removed to ensure there is sound concrete adjacent to the joint area. Based on the measurement of the opening, taken by the Contractor, and movement and mean size opening information, taken from the plans, the joint manufacturer is required to select the appropriate joint model. PCF joints are required to be selected from the Department’s list of approved PCF Bridge Joints.

PCF joints are required to be fabricated, delivered, and installed in lengths no less than 6 feet in accordance with the Specifications. Sections can be spliced using silicone sealant in accordance with the manufacturer’s recommendations.

The areas of joint installation must be sound, clean, dry, and frost free in accordance with the SS. All bridge deck patching and curing must be complete prior to installation of the joint. A manufacturer’s recommended and field applied joint adhesive is required for adherence with the substrate. Prior to the adhesive curing, the Contractor is required to apply a corner bead of silicone sealant along the entire length of the joint. The silicone bead is required to be tooled to blend with the substrate.

5.21 WATERPROOFING

Waterproofing is not normally required on bridges. If waterproofing is called for, it shall be in accordance with the applicable sections of the SS.

5.22 STRUCTURAL STEEL ERECTION

Structural steel delivered to the job site has been inspected during fabrication and should be handled with proper care during shipment. Occasionally, errors in fabrication occur that escape detection by the shop inspector. Pieces may also be damaged during shipment.

The PEMS should inspect the steel after it has been delivered to the job site and take necessary action to see that the steel is in satisfactory condition before it is erected.

The following schedule should typically be applied for payment of structural steel I-beams and girders as construction progresses:

90% when erected,

5% when bolting is complete,

2% when all welding and bolting is complete,

3% when the structural steel coating is complete.

If structural steel coating is a separate item, then payment should be completed when all welding and bolting has been completed.

Partial payment made for structural steel that has been stockpiled but not erected will be as per 111 of the SS.

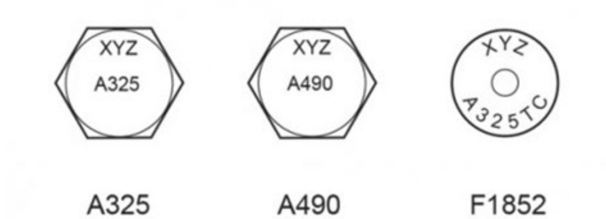
5.23 STRUCTURAL STEEL CONNECTIONS
It is essential that the elevation of the splice joints is established before permanent connections are made.

High tensile bolts and nuts and hardened washers are used for field connections of structural steel. When using this type of connection, it must be noted that the stress in the steel is transmitted through the splice by friction of the plates rather than through shear in the bolts. It is important that the contact surfaces of plates are free of rust, oil, burrs, or any other materials that would prevent a tight contact of the metal surfaces. Tightly adhering coating is acceptable.

The PEMS must verify that the bolts, washers, and nuts are as shown on the plans. High Tensile Bolts are manufactured of ASTM A325 high strength carbon steel. Grade A490 or F1852 may be furnished at no additional cost when grade A325 is shown on the plans.

Each bolt may be identified by the markings on the head of the bolts. Bolt heads are marked according to the table below.

Bolt Grade	Identification Markings on Bolt Head	Typical Bolt Head
A325	A325	
A490	A490	
F1852	A325 TC	



ASTM Typical Bolt Head Markings ("XYZ" indicates Manufacturer marking)

Nuts meeting the requirements of ASTM A563 or ASTM A194 are acceptable for use with A325 bolts.

The table below identifies acceptable nut types.

Nuts for A325, 490, and F1852 Bolts	
Type 1 Galvanized for Painted Steel	**Type 3** Weathering Steel
2H*, DH	DH3

*__Note:__ 2H heavy hex inch nuts may be used in place of A563/A563M DH nuts on Type 1 A325, A490, and F1852 bolts

A563 Grade **DH** A563 Grade **DH3** A194 Grade **2H**

ASTM typical Nut Markings

Bolts, nuts and washers delivered to the project must be in containers clearly marked with the contents and must be stored to prevent damage and rust.

It is necessary to ensure that the high-strength bolts used in structural steel erection meet all testing requirements prior to their use.

It is important that all bolts are properly and uniformly tensioned. Generally, such bolts are tensioned by use of an impact wrench. The Contractor must provide control of the impact wrenches to uniformly tension the bolts to the proper requirements in accordance with 711 of the SS.

Impact wrenches and manual torque wrenches must be calibrated at least once each day in a device capable of indicating actual bolt tension in accordance with 711 of the SS.

Procedures for inspection of bolted connections are outlined within the SS.

Occasionally, it is necessary to tighten a bolt from the head of the bolt rather than by the nut. In these cases, the hardened washer shall be placed under the bolt head rather than under the nut. This procedure is permitted only when working space does not permit wrenches to be placed on the nut. The washer must always be placed under the portion of the unit turned by the wrench.

Beveled washers shall not be used except to correct for bearing surfaces having a slope of more than 1:20, with respect to a plane normal to the axis of the fastener. When beveled washers are necessary, they shall conform to 910 of the SS.

No pin bolt fasteners shall be installed to breaking tension until the structural steel has been erected and adjusted for transverse alignment, longitudinal alignment, and for elevations at splice joints. A sufficient number of erection bolts, full size drift pins, and loose pin bolts shall be used to hold joints in correct position until solid tight pin bolts are installed. The installation of pin bolts shall start at the center of a joint and progress concentrically to the outer edges of the connecting plates.

Each fastener shall be installed to a minimum tension in accordance with 711 of the SS.

Installation tools used to install pin bolt fasteners to the tension specified shall be tested in the presence of the Engineer by installing a sample fastener in a calibrating device capable of indicating actual bolt tension.

5.24 COATING STRUCTURAL STEEL

5.24.1 Introduction

The structural steel coating industry utilizes the term "coating" for protective coverings applied to steel components since a "coating" may not always be paint. **For purposes of these instructions, the terms "painting" and "coating" will be used interchangeably.**

Coating of structural steel will be covered in the contract documents as well as in 619 of the SS.

Proper inspection of structural steel coating is critical to help confirm that the steel is protected from corrosion, which can weaken the structural members. Proper inspection is also critical to ensure compliance with laws regulating the generation and disposal of hazardous materials. On-site inspection and documentation of coating operations must be performed for all critical junctures of the operations and should be supplemented by random site checks during the operations.

For structures built prior to 1995, the assumption should be made that mill scale is present on the existing steel. All mill scale must be removed as part of the cleaning operations. Mill scale is a residue on the surface of the steel resulting from impurities introduced during the manufacturing process of the steel. These impurities rise to the surface as the molten steel cools. In the past, when lead-based primers were used, the mill scale could remain on the steel. When lead-based coatings were outlawed and zinc-based primers became the predominant coating material, the mill scale could no longer remain on the steel because mill scale and the zinc-based primers are incompatible.

5.24.2 Types of Coat Systems

The Department uses two systems for coating structural steel members:

1. **Structural Steel Coat System** – Defined in 619.09(a), this system is used when an entire structure will be coated. This system consists of an inorganic zinc primer, an epoxy intermediate coat, and a polyurethane top coat.

2. **Partial Coat System** - Defined in 619.09(b), is used when only portions of a structure will be coated. This system consists of an organic zinc primer and a waterborne finish coat.

The two coating systems are not interchangeable and each coat, in their respective systems, must be of a color to produce a distinct contrast with the next coat to be applied.

5.24.3 SSPC Certification

The SSPC is a non-profit professional society concerned with the use of coatings to protect steel structures. The organization publishes standards that are recognized world-wide by the coating industry. The Department references these SSPC standards in the SS.

For a contractor to perform structural steel coating on a Department contract, they must have a valid certification on file with SSPC. The type of certification required for a given structure is based on whether the structure may have a coating that contains hazardous components, such as lead or chromium. Two SSPC certifications are recognized by the Department:

1. **QP 1** certification is the minimum SSPC certification required for work on structures with existing coatings that do not contain hazardous materials.

2. **QP 2** certification is required for work on any structure with existing coatings that do contain hazardous material. A QP 2 certification is also acceptable for QP 1 work.

Contract pay items for cleaning bridge structures will indicate the level of certification required for a particular structure. If the pay item does not indicate the QP level required, contact the AE for further guidance.

A copy of the Contractor's QP certificate should be provided at the pre-construction conference. If the certification is not provided, the PEMS should request a copy. Certifications from SSPC are typically valid for one year. There is a phone number for SSPC on the certification that the PEMS may use if the validity of the certification is in question. If work is to continue past the expiration date of a QP certification, a new certification is required to continue work past the expiration date. There is no carry-over or "grandfathering" of QP certifications.

The Contractor must not perform any cleaning or coating work until a valid certification is provided and the Contractor's QCP has been approved.

5.24.4 Calendar Date Restrictions

Unless requested by the Contractor and approved in the QCP, no field coating is to occur between November 15 and the following April 1. This is due to temperature and humidity sensitivities of the coating materials. There are Department-approved coating materials that the manufacturer recommends for use at lower temperatures. To allow their use, the Contractor is required to include them in their QCP or amend their QCP to include them. If the Contractor requests to use a coating material that the manufacturer recommends for use at lower temperatures and includes this in their QCP, and the Department approves the QCP, then the calendar date restrictions shown in 619.10(a) are waived and the Contractor can coat the structure in temperatures as low as the manufacturer's recommended limitations shown on the product data sheet. While the temperature at the time of application applies to the manufacturer's recommended limitations, care should be taken in monitoring both the day and night temperatures when calculating an average temperature, as it applies to all cure times. Also, the SS require all coatings to be applied inside containment. Therefore, the ambient conditions inside the containment are the conditions to be monitored, rather than the outside conditions. This commonly is a factor when applying the prime coat after an abrasive blasting operation. For example, if the humidity level is high outside of the containment, it may still be acceptable inside the containment due to the dry air introduced into the containment during the abrasive blasting operation.

5.24.5 Quality Control Plan, QCP

Prior to beginning cleaning and coating operations, the Contractor must have an approved QCP in accordance with ITM 803. The QCP should be submitted to the PEMS at the pre-construction conference, or as soon as possible thereafter, to allow time for review and any necessary correction. ITM 803, sections 4 and 8, define the items that must be included in the QCP. A checklist of items to review within the QCP is included at the end of this section.

The PEMS is required to review the QCP and provide a written notice of approval or rejection to the Contractor. If the QCP is rejected, cite the items that gave cause for rejection. No work can begin until the PEMS has furnished written approval of the QCP to the Contractor.

5.24.6 Materials

Typically, coating manufacturers will submit samples of each batch of the various components of the coating systems they anticipate using each year to the M&T for testing. Contract sampling of coating batches is usually not necessary unless the contract calls for a non-standard topcoat color. A non-standard color is a color that is not listed in 909.02 of the SS. Note that the Department's approved list for Structural Steel Coating Systems lists an approval number (W-xxxxx) for the complete coating system (primer coat + intermediate coat + top coat), and is not an approval number for an individual batch of one of the components of the system. The Department still needs a sample from each batch for testing. The sample submitted must be from the same batch number as that used on the contract. M&T issues an approval "M-number" for each batch that meets SS. This M-number is the number that is reported on the material record within AWP. Contact the Chemistry Lab at M&T for any questions regarding coating samples or the need to sample a batch. It is the Contractor's responsibility to ensure that the materials used meet the SS. The Contractor should request that all approval numbers appear on the delivery tickets or, if required for other materials, the required certification accompanies the delivery documentation.

5.24.7 Beginning of Cleaning and Waste Stream Sampling

Unless superseded by other contract documents, the SS allow the Contractor to choose the surface preparation method in accordance with 619.08. Typically, the Contractor chooses to use abrasive blasting as the surface preparation method.

The contract documents should contain information on whether the existing coating is believed to be hazardous-based (contains lead or other hazardous components) on a plan sheet, in a table, or in a unique special provision within the CIB.

After the Contractor establishes containment acceptable for the job conditions (presence or absence of hazardous-based contaminants), they should begin abrasive blasting (cleaning) operations. The level of containment is more stringent for anticipated hazardous coatings than for anticipated non-hazardous coatings. The level of containment required is specified in 619.07(a) and detailed in SSPC-Guide 6. Except in cases where the Contractor is recycling the spent abrasive, the waste stream produced by the abrasive blasting operation will contain both the existing coating and a small amount of the spent abrasive blasting media. The waste stream thus consists of all of the waste stream (existing coating and spent blast media) for a particular structure, not just the existing coating.

It is not acceptable to "scrape" a sample of the coating and send it off for analysis prior to blasting operations. This process produces a sample of only the coating. It is not representative of the entire waste stream comprised of coating and spent blast media.

If a contract contains more than one structure, the waste stream for each structure must be kept separate and not mixed together. The waste stream for each structure will be classified as either non-hazardous or hazardous depending on the laboratory results of the waste stream samples for that particular structure.

5.24.7.1 Waste Stream Sampling Procedure

Regardless of whether the existing coating is advertised as hazardous or non-hazardous, the waste stream sampling procedure is identical. The waste cannot be labeled or classified as hazardous or non-hazardous until after the waste stream sampling procedure is followed. Sampling of the waste stream is governed by the SS and IDEM regulations.

The waste stream sample should be obtained at the end of the first full day of blasting for a particular bridge. The sample should be the product of random grab sampling that is representative of the waste stream. In all waste sampling, it is important to remember the term "representative". The waste sample obtained should be representative of the waste stream generated for that portion of the structure.

The PEMS should witness the gathering of the material from four or five spots in the waste debris. If there are areas that have red colored chips, a proportional amount of that material should be included in the sample. This is true of all visually different areas. There should also be portions of the sample from representative spots in the waste debris, even if it all looks identical. The total size of the sample extraction should be two to four cups (16–32 oz) in volume. This should be blended together to be uniform in appearance. This sample must stay in the custody of the Department (considered as the waste generator) or its representative at all times. The sample should be labeled appropriately and maintained. There should also be a copy of all documentation in the contract file. Quart size freezer food storage bags seem to work well, labeling the bags with a marker with the following information:

- Sample Number – Use the bridge file number or the last four digits of the number. On interstate, US, and state routes, the last four digits of the structure number can be used. For example, for multiple samples of a bridge on I-65, bridge file or structure number I-65-202-2345 becomes sample numbers 2345-1, 2345-2, 2345-3, etc. On local agency projects, the county name combined with the unique structure number could be incorporated into the sample number. The sample numbers for bridge 15 in Grant County would be: Grant 15-1, Grant 15-2, Grant 15-3, etc.

- Sample Date – date the sample is taken.

- Sample Location –A brief description of the location should be provided. For example: On Road ___ over ____ or under ____ and the containment number or lot numbers or whatever system you are using to track that area of the structure.

- Contract Number/ Project Number or any other information that will help the PEMS re-establish the identity of a misplaced sample.

Place the waste stream sample in the bag. Complete the chain of custody form that the Contractor's lab uses. Be sure to indicate that the test is to be a “full TCLP" (the Department has found that some of the old coatings contained high levels of cadmium, chromium, and other metals in addition to high levels of lead which will also cause the waste to be classified as hazardous).

Place the sample bag inside of another bag. Fold the chain of custody letter into fourths with the printed side out and place it between the two bags so the sample number can be seen and read. Both bags should have most of the air removed before sealing so they don't burst during shipment. The sealed sample goes into a commercial mail service delivery envelope for whichever commercial mail service the Contractor uses. The shipping label should be addressed directly to the lab and be billed to the Contractor's account. The Contractor is required to provide all of the materials (shipping envelopes, labels, chain of custody forms, etc.) needed, although the PEMS may keep some on hand if desired. The PEMS must take the sealed delivery envelope to the appropriate drop box and send it.

For convenience, the PEMS may insert a note in the commercial mail service delivery envelope requesting to be copied on the lab analysis results. In order to maintain the integrity of the sample, the PEMS must always maintain possession of the waste stream sample from each bridge from the time the sample is taken until the time the PEMS drops the sample in the commercial mail service company’s drop box.

The waste stream may only be classified as non-hazardous when the lab results for the sample for a particular structure are returned indicating threshold values from the TCLP analysis have not been exceeded. The waste stream may then be disposed of as special waste in an appropriate landfill. Do not contact IDEM or open an EPA ID number. It is not necessary. The material may be transported by a licensed waste hauler and no additional paperwork is required for the contract files.

If any of the contaminants in the sample exceed threshold values, the entire waste stream for that structure is considered hazardous and must be disposed of as such. No additional sampling of the waste stream for that structure is required. Finally, complete the US EPA Notification of Regulated Waste Activity Form and obtain an EPA ID number from IDEM.

5.24.7.2 Paperwork for Hazardous Waste Stream Disposal

If the sample results indicate a single contaminant exceeds the threshold values, the entire waste stream is considered to be hazardous-based. In these cases, it will be necessary to complete the US EPA Notification of Regulated Waste Activity Form (Form number 8700-12, OMB# 2050-0028). This form is completed by either the Department or the entity owning the structure (ex: county or municipality) or its representative administering the contract. Once completed, this form is submitted to IDEM. IDEM then assigns an EPA ID number (or RCRA ID number).

In order to keep the process moving, IDEM will cooperate with the Department via email/fax submission of the completed form to issue the EPA ID number ahead of time for use; however IDEM still needs to receive the original hardcopy of the form, with an original signature, in order to make the assigned EPA ID number active (or valid). The EPA ID number is required to transport the waste from the project site and should be provided to the Contractor as soon as the PEMS obtains it. In accordance with the SS, the Department is required to provide the EPA ID number to the Contractor within 30 days of the Department receiving notice that the waste from the project site is hazardous. To allow for mailing delays, the Contractor must not ship any waste until at least three work days after the PEMS has mailed the completed Regulated Waste Activity Form to IDEM. The EPA ID number must be active prior to transporting or shipping any hazardous waste from the project site. In accordance with EPA requirements, 619.07(b) provides a maximum time the waste may remain on site. The Department is required to obtain the EPA ID number. Therefore, the Department has a responsibility to get the EPA ID number and provide it to the Contractor as quickly as possible.

Information and instructions on obtaining an EPA ID number for the waste stream can be found on the IDEM website at https://www.in.gov/idem/waste/waste-industries/waste-transportation/how-to-obtain-a-new-rcra-id-number/. Information can also be obtained from the US EPA. For additional questions, contact ES, Environmental Policy section.

The Department has met with IDEM and has discussed and agreed to certain formats on how to complete the form. Instructions on how to complete the form are provided at the end of this section. The instructions provided herein in conjunction with the instructions provided with the form must be followed. The form must be filled out, have an original signature (not signed with black ink), and the original copy mailed to IDEM at the address indicated in the form directions.

There is a cost associated with opening an EPA ID number. Once a year, IDEM bills the Department for all EPA ID numbers ACTIVATED in the past year. Annual fees are assessed beginning January 1 of the new calendar year for the activities of the previous year. Thus it is imperative for the PEMS to take the necessary steps to update the status of the EPA ID number with IDEM as soon as possible. Payment of these fees is the responsibility of the structure's owner. Payment is handled at the District for state-owned structures or sent to the entity that owns the structure for an LPA structure.

If the existing coating was advertised as hazardous, a Contractor may present a waste material profile form to the PEMS and request that it be filled out and signed as soon as possible. This form is from the waste treatment facility. This does not need to be signed as soon as possible. The form should only be completed after the results of the TCLP test(s) are known.

If the TCLP results are returned showing the waste is hazardous, then a copy of the test results should be attached to the waste material profile form, the form signed by either the PEMS or the AE and given to the Contractor. The treatment facility may not accept the waste without this profile form to accompany it.

If the TCLP results are returned showing the waste as non-hazardous, a copy of all test results for the waste contained in that waste container should be attached to the waste material profile form. The PEMS should carefully read the waste material profile form and make sure that any sections or attachments that describe the characteristics of the waste are accurately represented. The waste material profile should match the results from the TCLP tests. Sometimes these have already been filled in by the Contractor. The PEMS should check to make sure the form they are signing is accurate. Once the PEMS is satisfied that the waste material profile form is accurate, either the PEMS or AE signs the form and provides it to the Contractor.

When transporting hazardous waste, a copy of the signed manifest must be obtained from the transporter (trucking company) for each and every load removed. As the generator or generator's representative, the PEMS must sign each ticket or an authorization form can be sent out with the first pick-up which authorizes the Contractor's foreman to sign for the generator. The PEMS is still required to be on site for the first pick-up. After the first pick-up, the PEMS could collect the manifests for his files from the Contractor's foreman. The PEMS must keep a running estimate of the tonnage of waste shipped (so many waste containers at so many tons per dumpster). Each bag of the collected waste has a shipping weight that can be used to compute the total weight of waste contained in each dumpster.

When all of the hazardous waste stream has been shipped to the disposal site and the PEMS is comfortable that there are no transportation issues, the Handler ID form (provided by IDEM when the EPA ID number was activated) should be marked as “INACTIVE” and returned to IDEM so the status of the EPA ID number may be changed to “INACTIVE.” Failure to do this will result in the District or owner continuing to be billed for having an active EPA ID number.

When the hazardous waste has been received, treated, and rendered to a “special waste” (normal construction waste) by the treatment facility, the treatment facility will issue a certificate indicating the hazardous waste has been rendered to a special waste status. These certificates are retained by the Contractor, but the PEMS must request a copy for the contract files. This certificate is a release of liability for the Department and is an important document to retain. The certificate should be included in the document files for the contract.

5.24.8 Cleaning and Coating Operations

The SS provides requirements in 619.11, 619.12, and 619.13 for shop-application of a coat of primer for new steel, field coating new steel bridge, and coating existing steel bridge. These sections indicate the level of cleaning required as well as the coating system to be used.

The Contractor shall establish containment for a certain section of the structure to be coated. Once containment is set up for an area, all associated operations (cleaning, priming, coating) will typically be performed before moving the containment to the next section of the structure.

There are several hold points identified in 619.04. Hold points are “stages” in a specific work activity in which the Contractor must stop work on that specific activity until the PEMS provides written approval to proceed. Hold points allow the Department the opportunity to inspect the work at the various stages and to identify and have problems addressed prior to proceeding. The Contractor must provide a minimum of one day’s notice to the PEMS in advance of each hold point. The PEMS should make every effort to be available for the review of the hold point and not delay the progress of the work.

5.24.8.1 Cleaning and Surface Preparation

Areas below bridge joints should be carefully checked. Contractors may request an alternate cleaning method within their QCP. An example of a requested alternate cleaning method would involve waiving pressure washing and utilizing hand solvent cleaning to remove grease and salts. This new process might be requested because pressure washing would cause logistical problems for the Contractor. The new process may be more practical for a structure over water or when peeling or delaminated coating is present. If containment is utilized, the addition of water can create a very slippery environment that is difficult to dry and can causes problems with gathering and cleaning abrasive blasting materials. If containment is not utilized, the pressure washing may undesirably spatter hazardous coating chips throughout the surrounding environment.

Before performing any other cleaning operation, the Contractor shall pressure wash the area in preparation of subsequent surface preparation operations. After pressure washing the area, areas containing grease, oils, or other contaminants not removed by the pressure washing must be removed by solvent cleaning. Solvent cleaning typically involves applying a degreasing solvent to a clean rag and wiping the affected surface to remove the contaminants. After the pressure washing and solvent cleaning have been completed, either an abrasive blasting or power tool cleaning shall be performed to remove the existing coating. The amount of existing coating required to be removed is determined by the level of cleaning required in the contract. The levels of cleaning are provided in 619.08 of the SS.

The Contractor shall use a dust collector during all abrasive blast cleaning operations. Using the dust collector provides a much safer working environment for both the Contractor’s personnel as well as the Department’s personnel. Use of a dust collector also provides better driving visibility for the traveling public. The Contractor shall provide personal protective equipment to Department personnel in in accordance with 619.07 of the SS.

5.24.8.2 Coating the Structure

Unless the contract documents specify differently, one of the coating systems described in 619.09 must be used. When an entire structure is being coated, the Structural Steel Coat System as described in 619.09(a) is used. Note that each subsequent coat must be a contrasting color to the previous coat. Additional information regarding the coating is presented in 909.1 and 909.02. The Department maintains an approved list of Structural Steel Coating Systems. The Contractor must not mix items from the approved list. All three components listed on a line must be used for the approved system. Using a primer from one system and either an intermediate or finish coat from another system is not allowed. Also, the Contractor shall not to mix batches of "part A" with "part B" from a differing M number or approval number. Typically, the contract documents will contain the color number for the finish coat and the PEMS should discuss this with the Contractor at the pre-construction conference. This is also the proper time to agree on the contrasting colors for the intermediate coat (when the finish coat color is established) and the prime coat. Also, it is recommended to use a contrasting color to the intermediate coat for the caulk. For example, if light green is the specified finish color, use a caulk of a similar light green color, a white intermediate coat, and a gray or green primer.

Once a section of the structure is coated, perform acceptance testing as described in 619.03 prior to granting permission to proceed or releasing the hold point. If the coating is too thin or has other defects, now is the time to correct the defects by using the defect repair procedures outlined in the approved QCP. Review the manufacturer's technical data sheets provided by the Contractor or obtained online from the manufacturer's website to verify the temperature range for the product and the required time before recoating, taking the contract's humidity and overnight weather information into account.

Striping the outside edges of all structural members prior to coating the fields or the remainder of the structure is good practice. When specified in the CIB, the stripe coat for both the intermediate and finish coat is considered a separate coat and must be allowed to dry to the same requirements as the top coat dry time for that product before applying the full field coat. Striping is not required on the prime coat. Striping helps to minimize cracking that often occurs at sharp corners.

5.24.8.3 Coating Concrete Surfaces

Unless specified on the plans, concrete surfaces are no longer sealed. When specified, seal coating shall be performed in all areas adjacent to traffic and should be executed while the traffic is restricted. This operation should progress slowly to allow the material to soak in. Do not rush. Areas away from traffic can be performed at the Contractor's schedule. Good practice, but not required, is to have the Contractor brush blast all areas to be sealed as they are cleaning the steel in the adjacent areas. If the contract contains requirements to remove graffiti, this is also a good time to perform that operation.

5.24.8.4 Coating Weathering Steel

Weathering steel (or corten or cor-ten) is steel made from a specific group of alloys that was developed to eliminate the need to apply a protective coating. Due to their chemical compositions, these steels exhibit greater resistance to atmospheric corrosion than other steels. The rust patina that forms on weathering steel becomes the protective coating. For the first several years that the weathering steel is exposed to the atmosphere, water runoff from the weathering steel may result in rust-colored staining of nearby concrete surfaces. This staining looks unsightly and is the primary reason why the plans should show the ends of each steel structural member manufactured of weathering steel located at an expansion joint to be coated. Weathering steel, in accordance with 619.11, must be coated using the structural steel coating system specified in 619.09(a), with the exception that the finish coat is a different material, color, and sheen in accordance with 909.02(e). The prime coat and corresponding intermediate coat shall be from a system shown on the approved list. Other than the requirement that the finish coat must be compatible with the chosen intermediate coat, there is no requirement that the finish coat be from an approved list. An approved list for the finish coat for weathering steel does not exist and any material meeting the requirements of 909.02(e) and compatible with the intermediate coat may be used. The material proposed to be used by the Contractor as the finish coat must be sampled and submitted using the Department's typical sampling and submitting procedures for coatings.

5.24.9 Method of Measurement

Partial or complete coating of bridge steel will not be measured for payment. The estimated area of steel to be coated is found on the bridge summary table within the CIB and is furnished on a "for information only" basis.

5.24.10 Basis of Payment

Coating of existing steel bridges should have a minimum of two pay items from 619 of the SS, Clean Steel Bridge and Coat Steel Bridge. Both items are paid at the lump sum price per structure. Estimate or pro-rate the amount of work that is completed each day and enter this on the Daily within AWP.

The cost for coating new steel bridges or beams/girders is included in the cost of the structural steel pay item and is not paid for under the coating item.

5.24.10.1 Pre-Established Remedies for Changed Conditions

Since there is some uncertainty at the time of bid concerning whether existing coating is actually hazardous, 619.20(a) and (b) make provisions for handling situations in which the laboratory analysis results classify the waste stream from the existing coating differently from what was indicated in the contract. The pre-established remedies apply only to situations where the contract identified the existing coating as non-hazardous, or zinc based, and the laboratory analysis indicate levels of contaminants in excess of the federal threshold limits, thus causing the waste stream from the existing coating to be classified as hazardous. Three situations are described with corresponding percentage adjustments. The three situations involve discovery of hazardous materials but no mill scale, discovery of mill scale but no hazardous materials, and discovery of hazardous materials and mill scale.

Structures exhibit varying levels of mill scale which must be removed prior to application of zinc-based primers. Removal of mill scale generally can be performed along with the removal of the existing coating, using the same blasting media. The Contractor's rate of progress will be slowed by having to remove mill scale.

If the contract advertises the existing coating as hazardous, or lead based, the provisions described in 619.20(a) and (b) do not apply. The Contractor should have already included costs for mill scale removal and hazardous waste disposal in their bid.

Conversely, if the contract documents advertise the existing coating as hazardous, or lead based, and the laboratory analyses indicate the levels of contaminants are not above the federal threshold limits, the waste stream is classified as non-hazardous. In this situation, the Department has no basis for requesting a partial credit for the cleaning item. This situation occurs because by the contract documents informing the Contractor that the existing coating was anticipated to be hazardous based, the Contractor would have brought and set up the containment required to remove hazardous based material.

Per the SS, the fourth waste stream sample is taken when the last quarter of the structure is being cleaned. By the time the lab results are returned, and in most cases, the cleaning operation has been completed. The only operation which a credit may be requested is for the disposal cost of the waste stream. The cost for disposal at a hazardous waste facility should have been included in the bid, but since the waste stream is classified as non-hazardous, the waste stream may be disposed in a local landfill at a lower cost.

A few individuals in each District have attended an SSPC bridge coating class. Questions regarding the pre-established remedies for changed conditions can be directed to the appropriate FE in CM or to the appropriate individual that have attended the SSPC coating class within the District.

5.24.11 Construction Documentation

Make a chart or drawing of the sections of a structure before the beginning of the cleaning operation showing the assignment of lot numbers to the entire structure, based on the estimated square footage of steel and the lot requirements noted in the SS, to promote uniformity in QC documentation and to aid in possible future investigations.

Maintain a copy of all of the related items for the EPA ID number, (sample information, chain of custody, lab test results, application, manifests, certifications from treatment facility, all related correspondence, etc.) along with the completed environmental impact study in duplicate in the contract files and as a packet to be given to the District Environmental Services for their records. The environmental records copy must be included with the archived records for permanent storage. This also includes non-hazardous determinations of a waste stream from a contract that was advertised hazardous.

Where there is no documentation of the existing coatings being hazardous or any discovery of the same, this documentation should not be archived.

Final quantities for the cleaning and coating items are based on the square footage of the bridge deck area. This measured quantity is defined in 619.17 as the product of the out-to-out bridge floor length as measured longitudinally along the centerline of the structure and the out-to-out width measured on a line perpendicular to the centerline of the structure. The product should match the unit quantity shown in the schedule of pay items.

5.24.12 Bridge Coating Quality Control Plan Checklist

Signed and Dated Letter of Transmittal with space for INDOT Approval Signature.
Names, Qualifications, Phone Number(s), Duties, and Employer of QC Personnel (QC Manager, QC Site Manager, QC Technician).
Type of Coating (New Steel, Existing Steel on Entire Structure, Beam Ends, etc.) and Coating System proposed for Use.
Copy of the Traffic Maintenance and Management Plan and Contact Information for the Worksite Traffic Supervisor.
Work Schedule showing planned start and stop dates and any contract date restrictions.
Detailed Description of the Containment (including level of containment) and Waste Stream Disposal and Handling.
Detailed Description of the Cleaning and Blasting procedures and equipment for each structure including dust collector manufacturer specifications (in order to validate the proposed dust collector's capability to maintain the proper environment in the size of containment proposed).
Spill/Waste Contingency Plan including a list of the tools that will be maintained on site solely for this purpose, where they will be stored, and the name and contact information of the onsite person certified in hazardous component (lead) abatement (if necessary).
Waste Training Program including a history of training dates for all job personnel.
Waste Container Labeling (what will the label read, when will it be placed, etc.) In addition to the information required in the SS, IDEM has requested that the sample date and sample number of the first sample at each structure be included on that label.
The exact location of the waste stream storage area and the method of collection and agreed method of transportation to the storage area, if necessary. Sometimes the site characteristics do not allow a safe location for a roll-off dumpster or disposal container.
Name of the testing facility that will be analyzing the waste samples and how the samples are to be transported and the necessary materials to be furnished to the PEMS.
Both Special Waste and Hazardous Waste Disposal Plans should be included. The appropriate plan will be implemented once a determination (non-hazardous or hazardous) of the waste stream is made.
Where will other project-generated waste (spent solvents, empty cans, etc.) be disposed. This should include a statement of understanding that these will not be mixed with any waste stream until it is determined to be Special Waste. At that time normal non-hazardous (special) construction waste and debris may be co-mingled for disposal purposes, if desired.
Copy of the Health and Safety Plan with documented training for each employee. This should include a list of PPE provided and the necessary monitoring that will be observed per OSHA and IDEM for the employees. Also, a statement of the required environmental testing that will be done before, during, and after operations on an advertised hazardous removal or at discovery of an existing hazardous material.
Proposed materials, origin of materials, storage of materials, and safety data sheets (SDSs) for all materials to be used on the job including coating, caulk, thinners, sealers, etc.

Weather limitations of all materials should be shown on the SDSs.
Request to work outside the dates shown in the SS, if desired. If the weather and temperature limitations, as recommended by the manufacturer, are requested to supersede the SS, this must be done in writing. If not, the limitations as stated in the SS apply.
Coating information (storage, mixing, thinning, curing time, etc.) and system shall be shown in the MSDSs. The color of each coat shall also be stated and comply with the contract requirements.
Copy of Contractor's SSPC-QP 1 or QP 2 certificate; also individual required certifications for lead abatement, QC/QA, worksite traffic supervisor, etc.
Coating procedure and proposed equipment.
Description of the material and amount if the coating is to be thinned should be included in the MSDSs.
Proof of contact with IDEM, local air pollution control board, and any other regulatory agency. This should be a statement from the local governing municipality or county stating that they have no regulations that exceed IDEM's or a statement advising that there are. This can be valid for 2 years and maintained on file for any work that falls in the same jurisdiction.
Proposed methods and frequencies of sampling, testing, calibrating, construction control, monitoring, etc. Any methods that are identified by reference name or number should also include a description of the importance and all job specific information.
Provide the references listed in section 8.1 of ITM 803 at the project site and mention where they are located.
Describe the method provided to allow the PEMS to access the work area.
List of the QC Instrumentation to be used with serial numbers and date of last calibration.
List which of the following QC inspection points listed in section 8.5 of ITM 803 will be performed.
Sample of the QC recording forms that comply with the SS. QC testing showing locations and frequencies and how the dry film thickness is to be obtained for each lot for all coats.
Describe surface profile testing, surface profile requirements, and documentation on the QC recording form.
Describe the film thickness testing and the film thickness requirements.
Describe the method used to determine the random location for checking the coating thickness within each lot.
A statement indicating that if there are defective areas, the contractor will propose a repair procedure for review and approval by the PEMS.

5.24.13 Department Instructions for Completing the Regulated Waste Activity Form

Section 1 – Reason for Submittal. Generally the box marked "To provide Initial Notification of Regulated Waste Activity (to obtain an EPA ID Number for hazardous waste, universal waste, or used oil activities)" is selected as the reason for the submittal.

Section 2 – Site EPA ID Number. Leave Blank. This is provided by IDEM.

Section 3 – Site Name. For uniformity, the following naming convention has been agreed to between IDEM and the Department and should be used.

- Interstate Bridges – the words "INDOT BRIDGE" followed by the bridge structure number (without dashes.) Ex.: for structure I-69-22-4423, the site name would be shown as: INDOT BRIDGE I 69 22 4423

- US Highway Bridges – the words "INDOT BRIDGE" followed by the bridge structure number (without dashes.) Ex.: for structure 50-15-0569C, the site name would be shown as: INDOT BRIDGE 50 15 0569 C

- State Bridges – the words "INDOT BRIDGE" followed by the bridge structure number (without dashes.) Ex.: for structure 13-48-5622A, the site name would be shown as: INDOT BRIDGE 13 48 5622 A

- County Bridges – All Indiana counties except for Marion use the same format for naming the bridges located in their county, County Name xx xx; Marion County is Marion County xx xxxx x.

  There are two scenarios for the site name for a county bridge:

  1. If the bridge spans another street - the name of the county followed by the county bridge number. Ex.: for Johnson County #15 over Main Street, the site name would be shown as: Johnson County 00 15.

  2. If the bridge spans anything other than another street (a river, stream, ditch, railroad, etc.) - the name of the county, followed by the name of the feature crossed, followed by the county bridge number. Ex.: for Marion County #4901 that crosses Buck Creek, the site name would be shown as: Marion County Buck Creek Bridge 00 4901 0.

- Toll Road Bridges – the words "TOLL ROAD BRIDGE" followed by the bridge number (with dashes.) Ex.: for structure 53-2, the site name would be shown as: TOLL ROAD BRIDGE 53-2.

Section 4 – Site Location Information. Since bridges do not have street addresses, the following convention has been agreed to between IDEM and the Department and should be used for the street address.

- Interstate Bridges – the name of the interstate first and then the name of the entity of the feature that the bridge spans followed by the reference post number. Ex.: for structure I-69-77-3589, the site location should be shown as: I 69 & US Hwy 31 RP 235 plus 58

- US Highway Bridges – the name of the US highway first and then the name of the entity of the feature that the bridge spans followed by the reference post number. Ex.: for structure 52-46-6571, the site location should be shown as: US Hwy 52 & White River RP 145 plus 08

- State Bridges – the name of the state highway first and then the name of the entity of the feature that the bridge spans followed by the reference post number. Ex.: for structure 72-87-2445, the site location should be shown as: SR 72 & NS Railroad RP 42 plus 94

- County Bridges – the street name of the bridge first and then the name of the entity that the bridge crosses. If further clarification and more specific information is needed, the longitude and latitude (degrees, minutes, seconds) can be added, especially if the bridge spans a river, road, etc… in multiple locations in the county. Ex.: for the Post Road bridge over Grassy Creek, the site location should be shown as Post Rd & Grassy Creek or Post Rd & Grassy Creek 86 35 27 37 44 50

- Toll Road Bridges – the name of the interstate first and then the log mile. Ex.: I 90 LOG MILE 53

- For the City, Town, or Village – the name of the nearest city, town, or village in the county where the bridge is located

- For the County Name – the name of the county where the bridge is located. For bridges that are on the county line, enter the name of the "lead" county agency for the project

- For the Zip Code – the zip code of the city used for the bridge city, town, or village.

Section 5 – Site Land Type. Check the appropriate box. Typically, this will be "State", "County", or "Municipal".

Section 6 – North American Industry Classification System (NAICS) Code(s) for the Site. Use the six-digit code **238320**, since bridge coating is one of the illustrative examples listed in the NAICS information. The NAICS website, www.naics.com may be viewed if other codes are desired.

Section 7 – Site Mailing Address. Enter the address of the entity that owns or is responsible for the bridge.

Section 8 – Site Contact Person. This is the person that IDEM will contact or send communications to regarding the bridge. This typically is the PEMS. There should also be a contact name and address for the person who will be preparing the follow-up paperwork after the contract is completed. This could be the same PEMS or it might be the AE or a County Engineer. Around the end of the calendar year, a status form is generally sent to verify that this EPA ID Number was issued for a one-time generator (the owner). Failure to complete this form and return it in a timely fashion is considered an IDEM violation. After that form is returned, the billing will be sent to the waste generator (the owner). There is also the possibility of a site visit/inspection by an IDEM representative prior to closing the EPA ID Number and, if so, there will be inspection forms for the contact person to sign. If necessary, a change form can be requested from IDEM to correct or change the contact person for all further communications.

Section 9 – Operator and Legal Owner of the Site. This is the entity that is responsible for and has authority over the bridge. It will be one of the following: INDOT, Indiana Toll Road Concession Company (ITRCC), or the name of the County/Municipality. The owner and operator are usually the same entity. The Date Became Operator and Date Became Owner is a required entry. This is typically the year the bridge was constructed or the date the current owner obtained the bridge.

Section 10 – Type of Regulated Waste Activities. For subpart A, question 1, select the level of generation anticipated for the contract. Most bridge coating jobs that do not recycle the blast media are considered a large quantity generator or LQG. The remaining questions in subpart A, B, and C are typically “No” answers.

Section 11 – Description of Hazardous Waste. Follow the directions on the form regarding the order in which they are to be listed. The waste codes entered in part A will also be entered in part B. Typically, lead is the contaminant, although other contaminants may be present that exceed the threshold levels. The PEMS is advised to check the lab report to make sure that all contaminants exceeding the threshold values are listed in the order stated in the instructions. Two of the more common waste codes for contaminants present in the bridge coating waste residue stream are chromium (waste code D007) and lead (waste code D008). The waste codes may be obtained from the 40 CFR 261.24.

Section 12 – Comments. Enter any other information pertinent to the site. Comments are not required but are encouraged to clarify any confusing entries or information. Please restate any information that is not clear.

Section 13 – Certification. The person with the authority to sign this document. The PEMS should check with their AE or DCD for the District’s procedures regarding signing. This is the section that requires the original signature (in other than black ink) and, when IDEM is in receipt of this form, makes the assigned EPA ID number active.

5.25 RAILINGS

Most bridge contracts now specify concrete railing. The line and grade of the railing should not follow any unevenness of the superstructure. The railings must be in accordance with 706 of the SS. If either class A or C concrete is used in slipformed railing, water reducing admixture will not be required in the mix.

Concrete railings should not be placed until the falsework for all spans under RC slab structures have been removed. Coping forms may remain in-place while bridge rail is being cast on superstructures supported by structural members. Slip forming method may be permitted to place concrete railing providing the Contractor has demonstrated the ability to produce barrier rail in accordance with the SS. This demonstration should be performed in the presence of the Engineer and include the sawing of the wall to ensure adequate consolidation of the concrete around the reinforcing steel.

Particular attention should be paid to the rubbing or sealing provisions set out for the railing. If the railing is not in compliance with the design or does not present a uniform appearance of smoothness or color, or is not otherwise a workmanlike job, it may require removal and replacement at the Contractor's expense. A minimal amount of small air bubbles on a surface are an inherent characteristic of the concrete and an acceptable part of the finished surface.

5.26 CONCRETE STRUCTURAL MEMBERS

Concrete structural members are inspected during production at the plant. If the PEMS has not received test reports for bearing pads before the structural members arrive at the job site, the DMTE should be contacted to verify that the bearing pads have been sampled. Care shall be taken when handling and shipping precast members to protect them from damage in accordance with 707 of the SS.

The erection of concrete members should normally commence at the centerline of the structure and proceed out to the curb. Any shifting of the members must be done while they are held free of the supports by the hoisting device. If the method of lifting the structural member in the field differs from the method shown on the beam fabrication working drawings, the Contractor must submit working drawings and calculations for the alternate method prior to lifting, in accordance with the SS. Members must be set to proper line and grade with uniform bearing on bridge seats, mortar joints, or bearing pads as required by the plans.

Partial payment for concrete structural members stockpiled, but not erected, shall be in accordance with 111 of the SS.

5.27 BRIDGE DECK OVERLAYS

Several types of overlay mixes may be used for bridge deck overlays in accordance with the contract documents. Bridge deck overlays shall be in accordance with 722 of the SS.

A mix design for bridge deck overlays is required to be submitted to the Engineer a minimum of seven calendar days prior to use and calibration of the mobile mixer. Trial batch demonstrations are required for Prepackaged concrete patching material, CPM, Ordinary Portland cement-based concrete, OPCC, Rapid hardening cement-based concrete, RHCC, LMC-Very Early Strength, LMC-VE, and Silica Fume Modified Concrete, SFMC, overlays.

The trial batch demonstration for all mix types involves a demonstration and verification of the mix design, simulating the placement properties, delivery time, discharge rate, slump loss with time, air content and compressive strength. It should also involve a meeting between the Contractor, material suppliers, and the Department to discuss the mixing, delivery, placement, finishing, curing, and compressive testing. Representatives from either the LMC-VE or SFMC producers are required to attend the trial batch demonstration and be present at the start-up for the initial deck placement. M&T will have the option of waiving the producer representative attendance requirements if the Contractor provides sufficient evidence of adequate experience with producing and placing the required mix.

5.27.1 Preparation of the Deck Floor

Existing deck overlays shall be removed. In addition to the overlay removal, the plans should indicate an additional depth to be removed. If the plans are silent on an additional depth to be removed, an additional depth of 1/2 in. should be removed.

For existing decks without a previous overlay, removal shall be performed with a milling machine for a depth as indicated on the plans. If the plans are silent on the removal depth, the milling depth shall be to 1/2 in.

After initial surface removal and cleanup, either hydrodemolition or hand chipping will be required to remove any remaining unsound concrete. Hydrodemolition will be indicated within the contract documents if this method is intended to be used. The use of hydrodemolition, and the associated requirements for the equipment calibration and process cleanup, is described fully within 722 of the SS.

Regardless of the method of removal, operations shall stop when it is determined that sound concrete is being removed. Any changes in equipment or operations should be agreed upon before operations are resumed. In locations where the deck is determined to be unsound for more than half of its original depth, the concrete should be removed to full depth, except for limited areas as determined by the Engineer.

When removing deck material adjacent to reinforcing bars, if the bars have been exposed for a length greater than 2.0 ft and the bond between the bars and adjacent concrete has been destroyed, the concrete adjacent to the bars shall be removed to a minimum clearance of 1 in. around the entire periphery of the exposed bar.

After removal operations, the entire deck, including the areas around and under exposed reinforcing bars, is required to be heavily sand blasted to expose fine and coarse aggregates and to remove small amounts of remaining unsound concrete or laitance layers from the exposed surface. The surface is then required to the thoroughly cleaned of all dust, chips, water and foreign materials in order to achieve a firm, solid surface for the overlay to adhere. Water blasting, at a minimum pressure stated within the SS, may be used in lieu of sandblasting when hydrodemolition is specified in the contract documents. Sandblasting or water blasting will be performed in two passes with the second pass performed at right angles to the first pass.

5.27.2 Bridge Deck Patching

A vacuum device is required to remove all water from prepared cavities. Patching of bridge decks can be made using either bridge deck patching concrete, overlay concrete, or concrete patching material from the Department’s approved list for Rapid Setting Patch Materials. Consolidation by internal vibration is required.

Full depth patching is required to be performed prior to overlay operations. Epoxy resin adhesive is required to be used to coat the surfaces of prepared cavities and all exposed reinforcing bars within the cavity.

For full depth patched decks, equipment can be operated on the deck once a modulus of rupture of 550 psi has been reached for the patching material.

For partial depth patches utilizing overlay concrete, cavity surfaces are required to be coated with a bond coat, in accordance with the SS, except when hydrodemolition is used. Cavities are required to be filled at the time of overlay placement.

For partial depth patching utilizing rapid setting patch material, all patching materials are required to be approved by the overlay supplier for compatibility with the overlay materials to be used. Placement and curing shall be in accordance with the manufacturer's recommendations.

5.28 TEMPORARY BRIDGES

When the contract specifies a temporary bridge, the structure must be built in accordance with 713 of the SS. The Contractor must submit detailed plans for the proposed temporary bridge. The plans must be signed by and bear the seal of a registered professional engineer. CO will approve these plans prior to construction of the temporary structure. It should be noted that a temporary bridge open to the public is required to be inspected at least every 24 months, in accordance with the National Bridge Inspection standards. Contact the District Bridge Inspection group for further information and guidance.

The PEMS must perform a general check of the temporary bridge, as it is being placed, to see that it is being placed in compliance with the drawings and issued permits. A general check will include checking bents, bearing capacity, size and spacing of materials, connections, and joints.

The PEMS will document that the temporary bridge was built as per the bridge standard plans, contract plans, or approved temporary bridge plans from the Contractor, whichever the case may be.

Section 6:
Subbase

SECTION 6 – SUBBASE

6.1 SUBBASE

Most PCCP paving projects provide for a course of material, or subbase, to be placed under the pavement and on top of a thoroughly compacted subgrade. The purpose of the subbase course is to produce a uniformly composed foundation layer for the pavement. The subbase course has a low susceptibility to frost action which helps to greatly reduce or eliminate soil conditions that contribute to subsequent pavement pumping.

Prior to placing subbase, the subgrade must be completed and approved in accordance with the SS.

There are three types of subbase utilized with concrete pavements, reinforced concrete bridge approaches, or concrete patching operations. One type is “Subbase for PCCP” and consists of two aggregate layers. The top layer consists of coarse aggregate No. 8 and serves as the drainage layer for the subbase. The intent of this type is to allow water that enters the concrete pavement structure or concrete patch to flow through this drainage layer to the underdrain system. The bottom layer of subbase consists of coarse aggregate No. 53, which serves as a separation layer for the subbase. The separation layer function is to prevent the migration of fine particles from the subgrade below up and into the drainage layer.

A second type of subbase that may be specified is “Dense Graded Subbase” and only consists of a 6 in. layer of coarse aggregate No. 53.

A third type of subbase consists of a lean concrete used as a base material for concrete pavements, reinforced concrete bridge approaches, or concrete patches. This material must be in accordance with the SS for this type of application.

Refer to the typical sections within the plans to determine which subbase type is utilized for the contract.

Subbase material types consisting of only aggregates must be from sources on the QPL. Stockpiling and spreading of the material shall be by approved methods to prevent segregation.

Offset grade stakes may be set on both sides of the area to be covered with subbase. Forms are then placed, a scratch template will be used to check the subgrade. When forms are not used, checking shall be performed by measuring the appropriate distance down from a string stretched between the grade stakes. “Blue tops” may be set at subgrade elevation and used for final subgrade checking.

A tolerance of 1/2 in. from true subgrade is allowable. This 1/2 in. tolerance should be an average and not the normal tolerance for every elevation check made. If the Contractor uses a Global Positioning System, GPS, to control grades, the PEMS may require sufficient staking be performed to be able to check grade.

Subbase must be placed and compacted in accordance with 302 of the SS or RSP 309-R-793.

After the subbase has been completed to its finished grade, depth determinations should be made as required by the Frequency of Sampling and Testing Manual. If deficiencies are found, appropriate corrective steps must be taken. A permanent record should be kept of the date, location, and depth of all checks.

For aggregate subbases and unless otherwise specified, payment should be by theoretical (neat line) volume as shown on the contract plans. Material placed beyond the neat lines is considered to be excess. Any subbase material placed beyond the neat lines shown on the plans, will be considered as excess material and will not be considered for payment. If the Contractor is directed to place additional material outside of the planned neat lines by the Engineer, payment will be made for the additional theoretical volume of subbase material placed.

For lean concrete material used for subbase, measurement and payment should be by the square yard.

The method for using the Light Weight Deflectometer for testing compaction of granular materials will be in accordance with ITM 508.

Section 7:

Compacted Aggregate and Pavement Recycling

SECTION 7 – COMPACTED AGGREGATE AND PAVEMENT RECYCLING

7.1 SUBGRADE OR SUBBASE

In general, the following will apply to subgrade prior to placing compacted aggregate:

(a) The subgrade shall be treated in accordance with 207.04. Refer to the typical sections to determine the required type of subgrade treatment.

(b) The subgrade should be brought to proper grade and cross section at least 500 ft ahead of the placing of the aggregate. See that side ditches are adequate to provide proper drainage for the subgrade.

7.2 MATERIALS

Unless otherwise provided, compacted aggregate bases, surfaces, and shoulders should be in accordance with 904.02 and 904.03 of the SS.

The percent of moisture must be recorded on the weigh tickets by the supplier as required by 109 of the SS. The SS allow for a maximum percentage of moisture over which, deductions must be made.

7.3 PLACING AND COMPACTING AGGREGATE

In general, the aggregate must be laid to the depth specified by the contract typical sections and in accordance with 301 or 303 of the SS, as appropriate. Frequent checks must be made to determine whether the quantity being placed is appropriate, based on the planned quantity. On compacted aggregate base, surfaces, and shoulders, depth determinations must be made and permanently recorded by date, location, and depth.

Roller compaction should follow immediately behind the spreading operation to take full advantage of the moisture content in the aggregate mix. When directed, some additional wetting may be necessary for proper compaction. Compaction testing of aggregates is obtained by utilizing Light Weight Deflectometer, LWD, testing, in accordance with ITM 508 and the SS. Visual inspection may be used for acceptance in areas inaccessible to compaction equipment such as private drives and mailbox approaches.

During all placing and compaction, care should be taken to prevent segregation. Segregated areas should be removed and replaced. “Tailgating” of material is not permitted, except in limited areas inaccessible to the spreader. The finished course should be checked for proper cross section and smoothness longitudinally with a rolling 16 ft straightedge set to 1/2 in. clearance. Any variations exceeding the 1/2 in. clearance shall be corrected.

7.4 PAVEMENT RECYCLING

7.4.1 Pavement Recycling Process

Pavement recycling involves the removal of existing degraded or deteriorating pavements and utilizing the existing materials, along with additional additive components, to create a more homogeneous and viable pavement structure. Portland cement may be used as a stabilizing material. Corrective aggregate may be used to supplement material volume.

Once placed and compacted, the new pavement structure will be capable of supporting the normal required loadings of the roadway. The re-use of existing materials has the potential to save time, money, and energy. The processes used by the Department are described below.

(a) Cold In-Place Recycling (CIR)

A process for milling and pulverizing a portion of the existing asphalt pavement to a depth specified within the plans. Normally, the treatment depth should not exceed an in-place depth of 5 inches. The process involves mixing the milled and pulverized pavement with asphalt emulsion, water and, if necessary, additional additive components. Additional components such as portland cement or corrective aggregate may be incorporated into the mix when needed. The goal is to produce a homogenous recycled material for re-application. This process is achieved by in-place mixing without the addition of heat.

For CIR mixtures, pulverization is required to produce a gradation that meets the SS.

When required, corrective aggregate may be spread on the existing surface using a mechanical spreader or conventional paver.

Pulverized material, asphalt emulsion and any additives are required to pass through a mixing unit capable of producing a homogeneous recycled mixture.

(b) Cold Central Plant Recycling (CCPR)

A similar process to CIR and intended to be used for a portion of the existing pavement depth, this process removes milled materials from the roadway and transports that material to a nearby centralized mixing plant. At this location, and without the addition of heat, the milled materials are processed and mixed with asphalt emulsion, water, and any additional components such as portland cement or corrective aggregate. The uniform mixture is then transported back to the site and placed using a paver.

For CCPR mixtures, pulverization is required to produce a gradation that meets the SS. Crushed and screened material is required to be stockpiled and maintained to prevent reconsolidation.

Corrective aggregate, if required, may be either mixed with the recycled asphalt material during stockpiling or fed into mixing apparatus at the rate determined by the mix design.
Prepared materials should be processed through a mixing unit capable of combining all the materials and producing a homogeneous recycled mixture.

(c) Full Depth Reclamation (FDR)

A process for pulverizing and stabilizing an existing asphalt pavement for the full depth of the pavement section including the existing base and subgrade materials for the purpose of constructing a fully reclaimed base course (RBC). Processing of FDR occurs on site. As with all pavement recycling methods described above, this process does not involve the addition of heat.

1. Pulverization

When required, corrective aggregate is spread on the existing surface using a mechanical spreader, conventional paver, or tailgating with end dump trucks. The corrective aggregate is required to be spread to a uniform thickness with a motor grader.

The pre-determined full depth of asphalt pavement, base, subgrade materials, and any corrective aggregate is required to be pulverized to produce a homogeneous mixture. For cement or asphalt stabilized mixtures, the pulverization must produce a gradation that meets SS requirements.

2. Stabilization

The cement or asphalt additives used to stabilize the mixture may be dry powder or slurry. The pulverized surface is required to be scarified prior to applying materials in slurry form to prevent runoff or ponding. Dry additives are required to be spread onto the pulverized surface using a mechanical spreader.

7.4.2 Roadway Preparation

All snowplowable raised pavement markers are required to be removed from the roadway. Grass and other vegetation are also required to be removed from the roadway edges prior to beginning any of the pavement recycling processes to prevent contamination of the pulverized material. All areas of soft or yielding subgrade are required to be corrected before pavement recycling operations begin. In addition, prior to pavement recycling operations, existing structures should be lowered, properly covered, and filled with material compatible with the submitted mix design to maintain traffic.

7.4.3 Quality Control Plan

A quality control plan is required to be submitted by the Contractor a minimum of five calendar days prior to the required Just-in-Time Training for any of the pavement recycling methods utilized.

The plan should include:

- the proposed mix design,
- a start to finish process description including discussion on corrective actions,
- a list of proposed equipment,
- a list of proposed QC tests and testing frequencies to be used based on the Specification requirements,
- a description of the curing methods to be applied,
- corrective action measures in case of failed proofroll when using FDR.

7.4.4 Just-in-Time Training (JITT)

The PEMS, or designated representative, and the Contractor are required to attend a JITT course for the pavement recycling treatments specified for the project. The training class should be conducted at the project field or another convenient location for all contract construction personnel responsible for the recycling treatment and inspection of the work.

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

The Contractor is to provide a JITT instructor, mutually agreeable to the PEMS or AE, who is experienced in the construction methods, materials, and test methods associated with the recycling treatments specified for the contract. A copy of the course syllabus, handouts, and presentation materials is required to be submitted to the PEMS, AE, or designated representative at least five calendar days before the course is taught.

All discussions, questions, processes, and sequencing should be discussed during the training session. The intent of the training is to provide clear and concise information on the construction process and methods utilized for the pavement recycling work. Once completed, the Contractor and the PEMS should have a clear understanding of what, how, and when specific pavement recycling activities will occur.

It may also prove useful to have early discussions on how areas of the recycled material may need to be rectified prior to the final surface course. It is important to highlight distinctions between failing recycled materials or locations of failing subgrade. See section 7.4.8 below.

7.4.5 Weather Limitations
Pavement recycling operations must only be performed per allowable SS weather conditions. The PEMS or AE may restrict pavement recycling operations due to weather conditions.

7.4.6 Control Strip and Compaction
A test control strip is required to be constructed on the first day of production. This control strip will allow the Contractor to:

- Demonstrate the proposed equipment, materials, and processes.
- Determine the optimal rates of asphalt emulsion, water, and any additives.
- Determine the sequence and manner of rolling needed to obtain strength or density requirements.

In place density must be achieved using the same equipment, materials, construction methods, and density requirements used for the control strip. A new control strip should be constructed if there are changes made beyond the tolerances of the original mix design, equipment, or construction methods. The Contractor is required to determine and provide a rolling sequence from initial lay down through optimum field density using the nuclear gauge. After control strip approval, production may continue.

(a) CIR and CCPR
CIR and CCPR density must be achieved using an optimal rolling pattern, obtained from the control strip. Compaction should be monitored using a nuclear gauge in direct transmission mode. Rolling operations causing cracking, displacement, or other pavement distresses must be stopped and resolved, to the approval of the Department, before allowed to re-start.

(b) FDR

FDR processed material is required to be compacted in one layer. Compaction should be monitored using a nuclear gauge in direct transmission mode. Passes must continue until light is seen between the pad-foot roller drum and the mixture or when there are no wheel impressions from the pneumatic roller remaining in the placed FDR mixture. Stabilized material should be bladed and shaped with a motor grader then leveled to produce a finished grade tolerance of ±1/2 in. from the plan elevation prior to profile milling.

7.4.7 Curing

Before the placement of final HMA surface overlay, all types of pavement recycling must cure and remain in place for a minimum of three days and meet SS moisture requirements.

7.4.8 Final Surface Preparation and Overlay

The Contractor shall maintain all recycled material placed. Damage to the placed and completed recycled material must be repaired in accordance with the SS. The PEMS should determine the limits of material to be replaced by proofrolling or by directing the Contractor. Proofrolling requirements are specified within the SS.

If locations of failing subgrade are found, The PEMS should ensure the Contractor repairs them. The repair effort typically is included in the cost of subgrade treatment. The PEMS should utilize the Dynamic Cone Penetrometer (DCP) to help determine where failure has occurred and whether the Department should pay for additional subgrade treatment.

All monuments are to be re-established after the placement of the surface course.

(a) CIR

Once placed and after proper curing, CIR should be scarified in order to assure that the treatment has sufficient texture and shear strength for the intended HMA surface overlay. Scarification also provides sufficient uniformity of grade for a smoother overall pavement surface finish.

After scarification, the CIR should be lightly swept of all loose material and standing water using a rotary power broom immediately before placing tack and application of HMA surface. A tack coat is required only for the HMA surface overlay and applied immediately following the sweeping operation.

(b) CCPR

After placement and proper curing, the CCPR is required to meet straightedge smoothness and correction requirements.

In addition, the CCPR is required to be lightly swept of all loose material and standing water using a rotary power broom immediately before placing the required tack coat. Placement of the HMA surface course follows the tack coat.

(c) FDR

After placement and proper curing of FDR, proofrolling is required. Deflections over 1/2 in. are required to be corrected.

The Contractor is required to rework failed proofrolled areas by re-pulverizing and re-stabilizing. Subgrade failures are required to have the FDR removed, proper subgrade treatment placed, and HMA patching used to replace removed FDR.

FDR should be scarified to ensure that the treatment has sufficient texture and shear strength for the intended HMA surface overlay. Scarification also provides sufficient uniformity of grade for a smoother overall pavement surface finish.

The FDR is required to be lightly swept of all loose material and standing water using a rotary power broom immediately before placing the required tack coat.

Overlays over FDR should be as indicated within the plans. A tack coat is required over the FDR prior to placement of the planned HMA surface course.

Section 8:

Portland Cement Concrete Pavement, PCCP

SECTION 8 – PORTLAND CEMENT CONCRETE PAVEMENT, PCCP

8.1 INTRODUCTION

The Department has specifications for both QC/QA PCCP, in 501, and non-QC/QA PCCP, in 502. The SS for QC/QA PCCP requires a QCP in accordance with ITM 803. The major differences between the two specifications are the testing and documentation requirements. The planned quantity and planned use of concrete pavement will determine whether the pay items are from 501 or 502. There must be at least 7,200 syd of a concrete pavement item for 501 to be applied. If the contract starts as a 502 non-QC/QA PCCP pavement, but a significant increase in the quantity is authorized, then the DMTE should be contacted to determine if the pavement should be tested under 501.

The Contractor is responsible for designing the concrete mixes in accordance with the SS. All mix designs are reviewed for SS compliance. A trial batch procedure is required in accordance with 501 of the SS.

These instructions apply to both 501 and 502 concrete pavements unless specifically indicated otherwise.

8.2 PERSONNEL AND EQUIPMENT

The checking of equipment and tools is performed by the Department contract personnel. Give particular attention to the finishing machine screed crown set-up, the float pan crown, if used, or the crown in the rails of the mechanical float.

Equipment for making plastic concrete tests should be obtained through the DMTE before paving operations start. The equipment must be properly calibrated prior to use. Prior to a trail batch demonstration, a discussion should be held with the CCT on the operation to see they understand their responsibilities and documentation requirements. Prior to the start of the paving, a pre-paving meeting should be held with the Contractor and all Department field personnel involved in inspecting the paving operations to outline specific responsibilities and review the paving plan, QCP, mix designs, and schedule.

All materials must be accepted before being used in the concrete mix. The SS allow the use of blended pozzolan cements, coal ash or slag cement as an additive in concrete pavements when the ambient temperature is above 45° F during the entire placement period.

If problems are found, the Contractor must correct them, including removal and replacement, if necessary, before the contract is accepted.

For 501 QC/QA PCCP, the Contractor is required to have an ACI-Certified Concrete Field Testing Technician, Grade I, on-site to supervise the QC testing. Trial batches must be run for each mix design with the Department and the Contractor present and performing independent tests. The Contractor is required to provide a common testing facility for use during the contract. Good communications between the Department's field HT, the Contractor's paving foreman, and the batch plant are essential to help relay problems if they occur.

8.3 SUBGRADE AND SUBBASE

Prior to starting paving operations, the subgrade and subbase must be completed in accordance with the SS. Checking of subgrade and subbase must be done well in advance of the paving operations. In general, the Contractor should keep a minimum of 500 ft of subbase prepared ahead of the paving operation to allow time for proper inspection before concrete is placed.

8.4 SETTING FORMS

Almost all concrete paving, including shoulders, is performed using the slipform method of paving. However, the Contractor has the option to set forms and use various types of form riding paving equipment. Short gaps and tight areas may likely be performed using the formed method of paving. This particular section applies only when the Contractor uses the formed method of paving.

Form stakes, used to set forms to line and grade, should be set no more than 50 ft apart on the outside of each form line. The offset distance from the form line is usually 2 ft. Stakes are tacked for line on one side only.

When setting forms, the most important factor in maintaining a true line and grade is a full and complete bearing of the form base on the subbase. Tamping under the forms after they are set, or shimming with stones, loose material, or blocks of wood to bring them up to proper elevation should not be permitted. A form that is too low must be removed, suitable material added and tamped, and the form reset and checked. This operation must be repeated until the correct line and grade is obtained.

Forms must be anchored in place with a minimum of 3 pins per 10 ft section of form.

Check for tight and complete closure of all form keys, wedges, and latches. All forms should be inspected for proper support and should be checked with a 10 ft straightedge. Variations of 1/8 in. or more in 10 ft. must be corrected before concrete is placed.

Forms that will not straightedge to the above tolerance, which are bent, twisted, or will not match adjacent forms satisfactorily must be removed from the work.

8.5 ACCEPTANCE TESTING

As previously noted, the primary difference between QC/QA PCCP (501) and PCCP (502) is the procedure for testing the concrete. These differences are outlined below:

a. QC/QA PCCP (501)

Testing is based on random sampling of Lots and Sublots as defined in the SS. The testing is performed by the CCT. Standardized forms are available through the DO. Accurate and timely documentation are necessary to ensure proper application of the SS QA adjustment factors, in accordance with the SS. Daily review of this data is necessary to ensure proper tracking of lot and sublot quantities. The Contractor’s QC charts should be reviewed, and any problems discussed with the Contractor. Opening to traffic test beams are separate beams from those cast for acceptance purposes.

b. PCCP (502)

A standard concrete series of tests (air, slump, and yield) must be taken immediately after the paving starts and for any necessary adjustments of the batch weights made. Adjustments should be made by the Contractor as work continues. Tests are recorded and the results stored within AWP. The SS state the limits on all tests. The frequency of testing is outlined in the Manual for Frequency of Sampling and Testing located on the Materials and Tests website.

A water/cementitious ratio test is also made as soon as practicable. The results are reported on form ITM 403-18 within Appendix A of ITM 403. The water/cementitious ratio shall not exceed the limits set out in the SS.

8.6 PLACING CONCRETE

The subbase must be kept uniformly moist in front of placing the concrete mix to prevent the dry subbase from absorbing moisture from the mix.

The concrete is placed on the subbase and spread by means of a mechanical spreader. Strike-offs that do not have sufficient weight or will not level off the concrete at the correct elevation, shall not be used. Paving machines shall utilize mounted vibrators to consolidate the mix appropriately.

A sufficient amount of concrete must be kept in front of the entire length of the strike-off at all times, while moving forward, to prevent depressions in the surface from occurring. Where depressions do occur, they shall be filled and leveled to the correct surface of the adjacent mix.

The Contractor must place the concrete at joints carefully so the dowel bar assemblies are not displaced.

For formed paving, the edges of the pavement at the form line must be appropriately vibrated to prevent honeycombing. Care must be taken to see that the paving machine operator uses these vibrators only while the machine is moving forward. Inspect the pavement edge after the removal of forms and have any honeycombed areas patched before the edges are banked with earth or sprayed with curing compound. Patching of honeycomb must be performed immediately after removal of the forms.

8.7 PAVEMENT JOINTS

Joints are placed in concrete pavements primarily to control cracking and to permit placing of adjacent slabs. Poorly constructed joints constitute one of the greatest sources of trouble in concrete pavement construction. For example, poor construction of transverse joints can result in differential settlement between slabs causing bumps at each joint which negatively impacts the traveling public and the life of the concrete pavement. Regular and consistent inspection is important to achieve proper placement and finishing of joints.

When placing fresh concrete adjacent to a joint within a pavement, the existing joint must be protected to prevent mortar and fines from entering the joint. If this is not achieved, the joint will fail prematurely.

No two transverse joints, of any kind, should be spaced closer than the specified spacing.

Each type of pavement joint is discussed in detail in the following sections.

8.7.1 Longitudinal Joints

Longitudinal joints are constructed parallel to the centerline and allow a hinge type movement to occur between slabs. They may be either of the types shown on the plans or specified in the contract. Longitudinal joint spacing should not exceed 14 feet.

Tie bars are an integral part of a longitudinal joint and are installed using mechanical equipment, in accordance with the SS, or rigidly secured in place. Check that the Contractor uses the correct size and spacing of the tie bars.

Unless a particular type of longitudinal joint is specified, all longitudinal joints must be sawed in accordance with Division 500 of the SS. All longitudinal joint sawing should typically be performed within 2 to 12 hours after the pavement is placed. The slurry created by sawing operations must be completely flushed from the joint by a high-pressure water jet. All joints must be entirely clean and open for their entire depth immediately prior to sealing.

8.7.2 Contraction Joints

Contraction joints are placed across the pavement at right angles to the centerline to control cracking and, unless otherwise provided, must be sawed.

The maximum allowable contraction joint spacing is specified in the plans. When manholes, utility access ports, catch basins, inlets, etc. are located within the pavement, a contraction joint layout plan is necessary. No pavement block-out section should be closer than 4 ft from a contraction joint unless a contraction joint is incorporated as one side of a block-out section. Under no circumstances should the maximum contraction joint spacing be exceeded. Contraction joint placement is especially critical in urban pavement sections by helping to avoid random pavement cracking and deterioration after construction.

The subbase must be properly prepared at the joint location when either a welded dowel bar assembly, that rests on the subgrade, or a full depth separator is used. If needed, a template may be required for checking the subbase and the position of the dowels. The dowel position must be checked, as described in 8.10 of these instructions, to ensure all the dowels are parallel with both the horizontal and vertical profiles of the pavement section.

Dowel bar assemblies must be pinned securely to the subbase. The concrete must be placed so individual dowels, or entire assemblies, will not move from their true position during the paving operation. Dowels that do not remain parallel with the pavement will cause stress cracking and spalling of the pavement.

Contraction joints are to be sawed the full pavement width. The saw cut should commence as soon as the concrete has hardened sufficiently to permit sawing without raveling, usually 2 to 12 h after placement. If necessary, the sawing operations must be continued day and night, regardless of the weather conditions. The width of the saw cut should be measured for compliance. Immediately upon completion of the sawing operation, the joint must be thoroughly washed to ensure that all the slurry is removed and not permitted to remain and harden in the saw cut groove of the joint.

8.7.3 Sawed Joints

When sawed contraction or longitudinal joints are required, the work must be performed in accordance with all applicable provisions of the contract, plans, Standard Drawings, and SS. Contraction joints should be sawed within a period of 2 to 12 h after placing of the concrete to prevent the development of random and premature cracking. Sawing should start as soon as the concrete has hardened sufficiently so the sawing can be performed without undue raveling or spalling. If this process is followed properly, the result will be a clean and neat saw cut groove. Careful detailed inspection is necessary to see that the contraction joints are sawed prior to the development of random cracks resulting from poor timing. If random cracks develop, contact the AE immediately and secure assistance in determining the cause of the cracks, means of preventing them, and any corrective measures that may be required.

During the placing of concrete, the Contractor must accurately reference the location of the contraction joint assemblies so the saw cut is made directly over the center of the dowel bars.

The Department’s assigned inspector to the sawing operation should be thoroughly familiar with the applicable SS requirements and, in addition, provide detailed attention to the following:

1. Width of the saw cut
2. Depth of the saw cut
3. Straightness of the saw cut
4. Transverse saw cuts are at right angles to the pavement lanes
5. Saw cuts are clean.

8.7.4 Expansion Joints

Expansion joints are special-use joints constructed in new pavements to accommodate potential excessive slab expansion or movement without developing high compressive forces in the pavement. Expansion joints typically include dowels or other load transfer devices and allow independent movement only in the direction of expansion. Expansion joints are used only when called for in the plans. Expansion joint type and width are indicated on the intersection detail sheets in the plans. A careful study of all detailed intersections and if the planned joint arrangement does not indicate proper function, the layout should be discussed with the AE and the Designer.

Older expansion joints labeled as terminal joints at bridges, railroad grade crossings, or abutting existing jointed pavement, consist of a concrete sleeper slab installed below the joint, and the joint itself is filled with HMA mixture.

The more recent terminal joint designs used at bridges should be constructed at the specific locations indicated within the plans as either Terminal Joint, Type PCCP or Terminal Joint, Type HMA. Standard Drawings for both types of joints should be referenced and used when constructing these types of bridge terminal joints.

Both types of terminal joints continue to use a traditional sleeper slab below the reinforced concrete bridge approach, RCBA, and pavement sections, but eliminate the use of the older 24 in. wide HMA filled joint and replace it with a much smaller width joint (2 1/2 in. at 60^{o} F). This smaller width joint is filled with a pre-compressed foam on top of expanded polystyrene. The Terminal Joint, PCCP also utilizes 40 ft of jointed reinforced concrete pavement, JRCP, beyond the RCBA. The Terminal Joint, Type HMA utilizes a 2 ft concrete lug, attached to the end of the sleeper slab, and adjacent to the pre-compressed foam joint beyond the RCBA. Care should be taken to ensure that the sleeper slab is constructed in the same horizontal plane as the pavement that will be placed on it.

8.7.5 Construction Joints

A construction joint is a rigid joint that joins two sections of pavement together using deformed reinforcing bars.

Construction joints are commonly used at the end of a day's pour or whenever the paving is stopped for 30 minutes or more and the location does not fall at a contraction joint. The tie bars are pushed into the concrete's vertical face, to the required depth, through holes or slots in a header board. The free ends on the bars must be supported. When starting from a construction joint the Department's inspector must check the vertical face of the existing pavement for right angles and alignment.

The SS state that the construction joints must be a minimum distance from a contraction joint. This means that header boards must be placed exactly at mid-slab between preset contraction joint baskets, unless a contraction joint is used as a header location.

Contraction joints may be used as a construction joint, but care must be taken to see that the dowels are positioned parallel to the plane of the pavement, both horizontally and vertically. A slotted header board is recommended.

8.8 FORMED PAVING

It is the responsibility of the Department's assigned inspector to see that the Contractor's operation in placing and finishing concrete is performed in a manner that will produce a smooth riding pavement. Any variations that exceed the acceptable limits must be corrected preferably at the time of finishing.

The following are important elements in securing a smooth riding pavement:

1. Uniformly compacted subgrade and/or subbase.

2. Straight forms properly aligned and staked or properly aligned stringlines for slipform equipment.
3. Uniform consistency of concrete as specified.
4. Uniform spreading and consolidation of the concrete in front of the finishing machine to produce a constant elevation during the forward movement.
5. Correctly adjusted finishing machine that is in good condition and operating properly.
6. Correct and constant use of a true 10 ft straightedge which is cleaned and checked frequently.
7. Checking the pavement as far back of the float as concrete setting will permit.
8. Skilled and judicious use of hand tools.
9. Texturing at the proper time and in the proper manner.

The following is a discussion of operations and equipment used in the normal order for paving operations.

(a) Mechanical Spreader or Strike-off - A properly operating machine spreads the concrete uniformly over the subgrade in a manner that produces minimum segregation.

(b) Finishing Machine - The principal function of the finishing machine is to uniformly screed and consolidate the concrete mix. The rate of placement of the mix in front of the finishing machine must be matched to the finishing machine's capacity.

A uniform head of concrete should be carried in front of the finishing machine. The amount of surge under a screed is controlled by the head of concrete in front of it, the consistency of the mix, and the tilt of the screed. When the head is too high, an excess will pass under the screed making a bump in the finished pavement. A deficiency of concrete at any point along the width of the screed will cause a low spot at that point. The rear screed should cut the concrete off to the elevation and section of the finished surface, allowing a slight surplus of mortar for proper operation of the longitudinal float.

Tearing of the surface indicates too stiff a mix or too much forward travel as related to transverse motion. A non-uniform surface behind the finishing machine, such as deep or irregular corrugations, indicates improper adjustment or operation of the machine.

Floating of the pavement surface follows the finishing machine and is intended to further smooth and true the pavement.

(c) Mechanical Float - This is the next mechanically controlled piece of finishing equipment. Poor-quality work will leave irregularities that cannot be properly corrected by the hand finishers. A mechanical float may be used to correct minor variations, but anything other than this calls for immediate revision of the finishing machine operation. Low spots shall be corrected.

Even if the mechanical float is performing satisfactorily, changing conditions can affect pavement smoothness. These conditions may consist of items such as:

- concrete mix or consistency,
- working up or down grade,
- change in the drying conditions,
- change in the rate of cross slope, and
- time interval between placing of concrete and operation of the float.

Attention to these changing conditions will make the difference between an excellent pavement surface and a relatively poor one.

Floating prior to the initial settlement of the concrete is frequently the reason why pavements are found to be rough when straightedged the next day and require corrective action to remove the variations. Initial settlement of the concrete should take place before passing of the mechanical float. The float must be held back from the paver to allow for this initial settlement.

If the mechanical float is properly operated, the surface will require only minor hand finishing after its passage. The finishers following the mechanical float should have little to do except remove the slight trail marks and carefully check the surface. If the finishers are working hard at any time, a careful check should be made of the finishing machine adjustment in addition to a careful check of the float.

(d) Hand Finishers - Final checking of the pavement is done as far back as possible, but not so far that good texturing and edging cannot follow. Additional water for finishing purposes shall be limited to a quantity applied by fogging, as approved.

(e) Texturing - The pavement will receive a finish in accordance with Division 500 of the SS. Areas of the hardened grooved pavement which do not meet the contract requirements must be corrected by cutting acceptable grooves in the pavement with an approved mechanical grinder or cutting machine.

(f) Edging - This operation shall be performed in accordance with Division 500 of the SS.

(g) Pavement Smoothness - After the concrete has hardened, the profile of the surface shall be checked in accordance with Division 500 of the SS.

(h) Pavement Thickness - The PEMS must be alert for any operation that would contribute to thin pavement. The Contractor is responsible to ensure proper pavement thickness as shown in the contract documents. Cores shall be taken to check the pavement thickness in accordance with the SS. Factors essential to ensure proper thickness are as follows:

1. Check the correct crown in the equipment screeds. Carefully check the actual pavement crown several times each day, both before and after the concrete has set.

2. Check the stability of foundation under the forms, if utilized. Give particular attention if paving operations are caught in a hard rain.

3. Check for the removal of crown in the subgrade at transitions from crowned to flat sections and from flat to crowned sections.

(i) Hand Methods - Hand methods, in accordance with Division 500 of the SS, may be used on widened pavement and other locations as permitted.

8.9 SLIPFORM PAVING

Most mainline paving is currently performed by the slipform method. Uniformity and consistency are key concepts in slipform paving. The need for uniformity and consistency begins with the subgrade. Uniform and consistent conformance with both grade-line and cross-section of the subgrade affect the ability to achieve uniform slab thickness, final smoothness, and riding quality of the pavement.

To accomplish this purpose the Contractor will utilize an auto-grade machine with automatic grade control obtained from a pre-set grade-line to trim the subbase. This grade-line on each side of the pavement should be set, in or parallel with, the plane of the edges of pavement.

This same rule applies if the Contractor uses automatic grade control when slip-forming. If automatic grade control is used when paving, a common elevation datum must be used for both subbase and pavement to prevent deviation in pavement thickness and variance in concrete quantities.

After the subbase has been completed, contraction joint assemblies for jointed pavement may be set on the subbase. Pre-set pins or other procedures must be used to properly align the joint assemblies, since no side forms can be used for reference.

Uniform and consistent concrete mix is also important in slip-form paving. This concept will have a pronounced effect on the smoothness of the final pavement. A uniform slump can be achieved with the use of properly drained aggregate. Uniform mix consistency and low slump are necessary to minimize problems with edge slump and rough pavement. Inspection for uniform moisture in the subgrade ahead of the paving and water added to the subgrade are necessary.

The best results for controlling edge slump and smooth pavement are attained with a uniform and consistent concrete mix, rate of delivery to the paver, and lateral distribution and level of mix maintained at the main screed. Interruption in the truck cycle causing the paver to stop is a potential source of rough pavement. Therefore, paving speed should be coordinated with the concrete delivery rate to the paver. The interval between the spreader and the paver should be maintained so that a short delay at the spreader will not cause the paver to stop. A slow continuous paver speed should be maintained rather than starting and stopping. Since the main screed is producing the final profile and cross section of the pavement, a uniform level of concrete must be maintained across the entire width of the screed.

To obtain uniform consolidation and adequate density of the concrete, a series of internal vibrators are installed in front of the main screed. Frequent observation of the vibratory devices should be made to detect any failure of individual units. Inspection should be made on the configuration of the main screed after each major move of the paver to check for deviations from the required alignment. The pavement should be checked immediately behind the paver for conformance with the required cross section.

Periodic checks of the pavement thickness should be made. One of the more efficient methods is to insert a thin rod down through the slab to a metal plate set at a pre-determined point. Once removed, the depth can be measured from the rod. A depth check should be made at least every 400 to 500 ft when starting a project, then as necessary to confirm proper depth. The information should be recorded noting the station, offset, and depth.

Edge slump should be checked after the trailing forms have passed. Minimal edge slump is particularly critical when an adjacent lane is to be constructed. To protect against edge slump being caused by rainfall, auxiliary side forms and plastic sheeting, or other material, sufficient to cover several hundred feet should be readily available.

8.10 TEST PROCEDURE FOR CHECKING POSITION OF DOWEL BARS

After placement on the subgrade each dowel bar assembly should be visually checked for proper alignment. The bars must be parallel to the side and top of the pavement. A minimum of three bars in every assembly should be checked and reported. If any one of the bars is out of alignment, the assembly must be adjusted and every bar in the assembly needs to be checked. The check must be performed before the placement of concrete around the bars.

At the beginning of a paving operation, several assemblies should be checked after placement of the PCC prior to initial strike off to ensure no movement of the assembly has occurred during the PCC placement operation.

A commonly used method is the "dowel bar checker" which may be obtained at the DO. This instrument is a "U" shaped frame having legs of equal length that support a level dial (see Figure 8.10.1). It is first set on the side form or string line with the legs at equal distance from the joint, and the level adjusted until the bubble is centered. This is necessary to compensate for the grade of the pavement. Next, the legs of the checker are set on top of each dowel to be checked. If the bubble is in the center of the vial, the dowel is in the correct vertical position. If not, the dowel bar shall be marked and the Contractor should be notified.

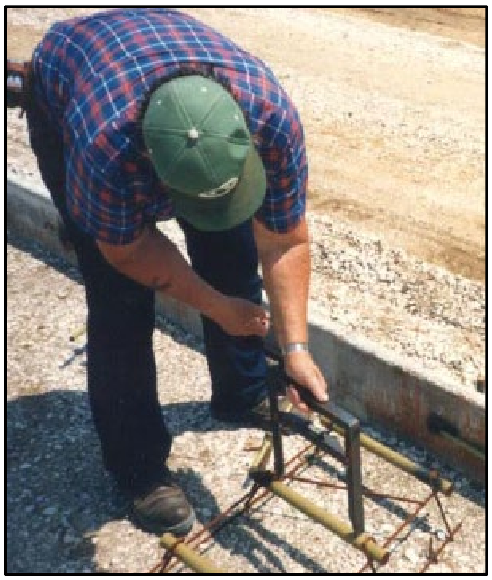


Figure 8.10.1. Dowel Bar Checker Device

8.11 PERMANENT MARKING OF STATIONING ON PAVEMENT

Station numbers must be marked on the right-hand side of the pavement (facing the higher numbers) with the nearest number about 8 in. from the edge of the pavement. The full station number should be placed every 100 feet. Intermediate points will be placed between full stations. At the beginning of each day's run, the plus of the station and the date should be marked. In the case of a divided lane, the station numbers are to be placed along the outside edge of the pavement, readable from the same direction as the flow of traffic. Cast iron dies of numbers are available from the DMTE.

8.12 CURING

All pavements must be cured using an approved method outlined in accordance with Division 500 of the SS. Curing operations must be continuous until requirements are met. During the curing period, any defects in the curing method must be repaired immediately. Curing should be checked daily during the entire required period. If there is any potential for the temperature to drop below freezing after any pavement is placed, the pavement must be protected by using insulated blankets or other approved means.

8.13 PAVEMENT SMOOTHNESS

The SS requirements for smoothness stipulate that PCCP smoothness is required to be checked as soon as the concrete pavement has cured sufficiently to permit testing. Longitudinal smoothness is checked by using an inertial profiler or a straightedge. Both the inertial profiler and the straightedge are furnished and operated by the Contractor. For contracts which include the pay item for Inertial Profiler, PCCP, refer to Section 11 of these Instructions which contain comprehensive information on Pavement Smoothness utilizing the IRI index and Inertial Profiler equipment. The PEMS or a designated representative should be present to observe PCCP smoothness checking operations to see that compliance with the SS is maintained.

When the Inertial Profiler, PCCP pay item in included in the contract, it is only used to measure smoothness on lanes meeting all requirements of 501.25 and on areas not exempted by the requirements of ITM 917. The 16 ft straightedge is used to check the longitudinal profile at all other locations. The 10 ft straightedge is used to verify transverse slopes.

If there is no pay item in the contract for Inertial Profiler, PCCP, the 16 ft and 10 ft straightedges are required to be used for all newly placed QC/QA PCCP. The 16 ft and 10 ft straightedges are required to be used for all non-QC/QA PCCP. For either of the straightedge situations mentioned, QA smoothness calculations are not performed.

The Contractor is responsible for furnishing and operating the 16 ft straightedge~~s~~ while Department personnel are responsible for furnishing and operating 10 ft straightedges. Contractors are also responsible for providing, setup, maintenance, and removal of all traffic control required to safely operate the straightedge.

8.14 CLEANING PAVEMENT

When the paver is supported by an existing pavement while placing widening, adjacent slabs, or incidental construction, care shall be taken that all mortar and concrete drippings are carefully and completely removed from the existing pavement without marring or damaging the existing surface.

8.15 SEALING CRACKS AND JOINTS

All cracks and joints must be sealed prior to discontinuing work for the winter or before opening the pavement to traffic.

Sealing of cracks and joints requires inspection and must be performed in accordance with applicable requirements of the SS.

Joints are to be thoroughly cleaned and inspected prior to sealing in accordance with Division 500 of the SS. All excess and unsightly sealing material shall be cleaned from the pavement surface.

8.16 PAVEMENT INSPECTION

Prior to opening a new pavement to traffic, the Contractor and the PEMS must inspect the pavement for any damage, including random cracks. All random cracking must be repaired prior to opening the pavement to non-construction traffic.

8.17 TEST BEAMS AND OPENING PAVEMENT TO TRAFFIC

For opening to equipment and traffic, the Contractor may choose to determine concrete strengths by using either the maturity meter or test beams. ITM 402 discusses the use of the maturity meter.

When test beams are used for opening to traffic, one or more sets of test beams will be made at each intersecting road and at any other location where the Contractor requests beams to control the cure period. The purpose of the beams at intersecting roads is to furnish a basis for allowing traffic across the new pavement.

Test beams are also required for trial batches when coal ash is used in the mix design and for all QC/QA PCCP mixtures.

Section 9:

Pavement Patching and PCCP Joint Repair

SECTION 9 – PAVEMENT PATCHING AND PCCP JOINT REPAIR

9.1 SELECTING PATCH AREAS

PCCP and HMA patching locations will be marked on the pavement by Department personnel, generally by the PEMS and staff. The PEMS should refer to the contract plans for specific locations identified by the Designer. However, patching quantities often are planned as a percentage of the entire pavement within the contract without specific locations identified. The use of a quantity based on a "percentage" of the pavement will require the PEMS to use sound judgment when marking the patching areas to verify that the worst sections are repaired without overrunning the contract plan quantity. A general procedure that can be used is as follows:

- Note the location of any patches that are specifically identified on the plans. If the planned patch locations equal the total contract quantity, then no further investigation needs to be done and the planned patches should be marked. Otherwise, continue below.
- Drive each lane of the entire job and note the general condition of the pavement.
- Determine the approximate total area of the pavement within the project limits.
- Determine the percentage of contract patching area over the total area.
- Pick an area that has a degree of deterioration that should be repaired and use it as an example to select other locations within the job.
- Drive the job again, counting the approximate number of locations that are similar to the example.
- Calculate the approximate total area of patching based on standard patch size along with any added areas of oversize patches added in.
- If the calculation is less than the contract quantity, continue to pick additional locations with decreasing degrees of deterioration until the contract quantity is met.
- If the calculation is more than the contract quantity, delete some less deteriorated patches until the contract quantity is met.

The contract quantity may not be enough to repair every location identified by the PEMS. The PEMS should contact the AE and the PM if there is concern that the contract cannot be properly completed without additional patching.

9.2 REMOVING PAVEMENT AND PLACING PATCHES

PCCP patching is covered in 506 of the SS. HMA patching is covered in 304 of the SS.

In addition to details within the Standard Drawings and plans, the guidance presented below should be followed when removing pavement and placing patches.

(a) Methods and equipment used in cutting, breaking and removal of the PCCP and HMA pavement must not cause structural damage to the pavement left in place. To help avoid damage to surrounding pavement, it may be necessary to use hand methods to trim and straighten the edges of the patch after removal of the pavement. Minor chipping of existing concrete pavement cannot be avoided in some cases.

(b) If the existing PCCP or HMA pavement is damaged, the Contractor must replace the damaged pavement at no additional cost to the Department, provided that the damage was due to poor workmanship. If the damage was unavoidable or was the result of previous damage not observed at the time the patch was marked, then the repair should be included in the patch and paid through the contract.

(c) Determine if the subbase is suitable to remain in place. The Contractor must not needlessly remove subbase during the pavement removal process and must recompact the subbase left in place. If the subbase is contaminated due to pumping, it should be replaced in kind and to the depth of the original subbase. If the contract does not include an item for new subbase material, the PEMS should contact the AE to confirm that items will be added to the contract to place new subbase material.

(d) If the existing subbase is clean, but is saturated or standing in water, the PEMS should contact the AE to determine if drainage pipe or drainage aggregate should be installed to drain the subbase.

(e) The depth of a full depth concrete patch should not exceed the depth of the existing PCCP pavement. Patching material should not extend under the existing PCCP pavement.

(f) PCCP partial depth patches may be constructed to a maximum of 1/3 the thickness of the existing pavement. The PEMS must verify that hand chipping tools or handheld mechanically driven equipment used for removal of unsound partial depth patch concrete are operated at a maximum angle of 45° from the PCCP surface.

(g) For concrete patching, longitudinal tie bars that are to remain in place must be straightened. Retrofit tie bars must be added as required, dependent on the length of the patch.

(h) For concrete patching, dowel bars must be installed at each end of the patch and intermediate D-1 dowel baskets placed within the new patch to match existing adjacent D-1 joint locations.

(i) PCCP concrete patch mix design, mix criteria, trial batch, and CMDP beam validation are required to be in accordance with 506 of the SS.

(j) Concrete patches shall not be placed on frozen subgrade, frozen subbase, or frozen PCCP.

(k) For HMA patches, a smooth riding surface must be maintained at all times. Any deformations are to be corrected immediately.

(l) For HMA patches, excavated patch areas are required to be filled with the HMA material specified in the pay item.

9.3 PCCP JOINT REPAIR

PCCP joint repair is an integral part of pavement maintenance and preservation. Joint repairs for PCCP include those for both partial depth and bottom-half of slab repairs. Repairs must follow the SS and Standard Drawings to be successful. Joint repairs can be performed when the ambient temperature is 50°F or higher. The work must be protected from rain and follow the QCP for the protection of edges and surface of the repair area.

9.3.1 Quality Control Plan and Trial Batch

A QCP, in accordance with ITM 803, is required for the operation. The specified Quality Control Technician, described within ITM 803, must be an ACI-Certified Concrete Field Testing Technician, Grade I. The requirements for the QCP are listed and described within the SS.

9.3.2 Concrete Mix Design

A CMD is required to identify the type of material to be used for the work. The allowable material types are listed and described within the SS. The SS also require a CMD to be produced and submitted by the Contractor for any of the patching materials utilized **except** when pre-packaged concrete patching materials, CPM, or rapid setting patching, RSP, materials are used.

9.3.3 Proportioning

The proportioning requirements for the allowed patching material mixes are listed within the SS. There are differences for specific type mixes. The CMD for the contract should be reviewed carefully and any errors corrected prior to the work progressing.

A trial batch production is required to be performed prior to use to verify that the repair concrete is in accordance with the appropriate concrete mix criteria listed within the SS. Specific trial batch testing requirements for compressive strength, modulus of rupture, and plastic testing for each of the allowable mixes is listed within the SS.

9.3.4 Construction

The PEMS and the Contractor are required to set-up an on-site pre-work meeting to discuss the work schedule, the traffic control plan, the equipment calibration and potential adjustments, the inspection and evaluation of the equipment, the concrete mix design for production, the Contractor's daily rate of production per work crew, and the QCP. Other issues for particular contract circumstances should also be discussed during this meeting.

The Department identification of repair locations should be performed by sounding and in coordination with the plan repair summary information. As the repair areas are located, they should be marked and recorded by size and location. The recording of repair area size and location can be used later as original information for payment and resolution of Contractor disputes. It is the Contractor's responsibility to remove only the areas marked and identified by the Department. If patch areas are cut larger or patch areas are added without the authority of the Department, those additional areas are not paid and are at the Contractor's expense. Contractor PCCP removal, in accordance with the SS, should follow the identification and marking of the repair locations.

Areas of less than 1 sq ft are to be removed by saw cutting and hand chipping rather than by machine. Sawing should be 2 in. deep within the marked area.

The same procedure described above should be used on jointed reinforced concrete pavement. Wire mesh exposed during removal operations is required to be removed. PCCP removal areas are not to remain open overnight.

For portland cement concrete pavement joint repairs, if there is a need for a transverse joint to intersect a longitudinal joint that has already been repaired, the longitudinal repair must have at least 12 h of curing, a passing visual inspection for repair soundness, and demonstrate adequate flexural strength of 500 psi for one individual flexural strength test or 3,200 psi for two individual cylinder breaks consistent with opening to traffic requirements. Visual inspection should include issues with debonding of the repair concrete or random surface cracks. Longitudinal joint repairs should stop 12 in. or more from a transverse joint.

Inspection of the milled surface of the repair area is required to help identify remaining unsound concrete. Remove any identified unsound concrete **except** if it is found below the tops of dowel or tie bars. When unsound material is found below the tops of dowel or tie bars, it can remain in place. No dowel bars are to be damaged during removal operations. Based on the exposure of dowel bars during the removal operations, the determination to transition a repair area to a full-depth patch is at the discretion of the PEMS.

Cavities of repair areas are to be left with a clean and irregular surface to help develop the bond between existing concrete and the new joint repair mix. All broken concrete should be removed, and the cavity swept clean. The cavity is then required to be thoroughly sandblasted and cleaned with compressed air to remove remaining dust and chips. Compressed air cleaning should occur as close to placing the concrete as possible, but not after the installation of any joint filler.

Joint filler material is required to be placed prior to placement of the new concrete mix. The placement should follow with the plans and Standard Drawings for the identified joint.

The placing and curing of joint repair concrete mix must follow the SS requirements to produce the best quality for the repair. Deviation from these requirements may cause undesirable results and the possible necessity to remove and replace the repair area.

All joint openings within the repair area are to be maintained for the full depth of the joint repair. Longitudinal and transverse joints should be sawed to produce a reservoir for sealant. Once sawed, the reservoir is required to be cleaned prior to placing the sealant. If a longitudinal joint was re-established by sawing, additional sawing to create a reservoir is not required. Sealing of joints is required to be with hot poured sealant, in accordance with the manufacturer's recommendations. The sealant is required to be placed to a level consistent with the SS.

Section 10:

Transportation or Operation of Heavy Equipment on Pavement

SECTION 10 – TRANSPORTATION OR OPERATION OF HEAVY EQUIPMENT ON PAVEMENT

10.1 TRANSPORTATION OR OPERATION OF HEAVY EQUIPMENT ON PAVEMENT

The transportation of heavy equipment, including cranes, mixers or other equipment exceeding the legal load limit will not be permitted on any pavement without a proper executed permit.

Equipment meeting the legal load limit requirements may be operated on pavement as long as necessary precautions are taken to prevent damage to the pavement and joints. Particular attention must be given to the edges of the pavement when driving this equipment on and off the pavement.

Under no circumstances should any equipment with steel treads, or equipment over the legal load limit with rubber treads, be permitted to operate on new pavement. The DDC may grant permission to operate equipment on old pavement. Tractors with cleats must not be permitted on any pavement surface intended to carry traffic except when crossing the pavement and then, only where the pavement is protected.

The Department does not accept the responsibility for any damage occurring during the Contractor’s transportation or operation of any equipment on the pavement. Any damage to the pavement should be reported to the AE and include a detailed description.

Whenever any equipment is being transported or operated on the pavement, all applicable safety measures must be followed. Warning signs and barricades must be erected and maintained as applicable.

Section 11:

Pavement Smoothness, High Speed Inertial Profilers, and the IRI Index

SECTION 11 – PAVEMENT SMOOTHNESS, HIGH SPEED INERTIAL PROFILERS, AND THE IRI INDEX

11.1 INTRODUCTION

All contracts containing QC/QA HMA and QC/QA PCCP require the final surface to be evaluated to determine the pavement smoothness. Smoothness is evaluated utilizing high-speed inertial profiler equipment to collect longitudinal vehicular reaction profiles of the finished surface. The profiles are then analyzed using specific software to compute the IRI for each profile collected on the contract.

Information on implementing IRI can be found under the **IRI Information** heading on the Department's website (https://www.in.gov/indot/doing-business-with-indot/home/construction-information/). The information provided includes links to the following:

- Certified Profilers & Operators
- IRI Field Guide
- IRI Field Guide for Areas of Localized Roughness, ALR
- IRI Payment Adjustment Spreadsheet – HMA
- IRI Payment Adjustment Spreadsheet – PCCP.

11.2 VERIFYING CONTRACTOR PERSONNEL AND EQUIPMENT

When the Inertial Profiler equipment arrives on the jobsite, Department field personnel will first review the **Certified Profilers & Operators** list on the Department's website under the **IRI Information** heading to verify that the Contractor's equipment has an active certification with the Department.

To confirm the accuracy and reliability of the equipment prior to operation, ITM 917 requires the **Checklist for Verification of the Inertial Profiler** to be completed while observing the Contractor performing the block test, the bounce test, and the longitudinal distance test. This checklist can be found in the appendix of ITM 917.

Inertial Profiler operators arriving on the jobsite will also need to be validated by Department field personnel by reviewing the **Certified Profilers & Operators** list on the Department's website to verify the Contractor's operator has an active certification with the Department.

11.3 OPERATION AND DATA COLLECTION

Once both the Contractor and their equipment have been verified, the collection of profile data with the high-speed inertial profiler can begin. The equipment is required to be operated at a constant speed within the manufacturer's recommended range and without braking or stopping so the introduction of false bumps or dips in the data can be avoided. All data collected outside of the manufacturer's recommended speed range or collected with braking or stopping events are required to be remeasured by performing additional data collection runs. Upon completion of data collection, the Contractor shall save the files in an unfiltered electronic format and follow the naming convention of ITM 917 to correctly organize the files.

There may be areas of the project that are exempt from Inertial Profiler operation. These areas are defined in the SS and within ITM 917. The Contractor may locate these areas prior to beginning any data collection runs so that these areas can be excluded from the final results. Any exempted areas will be checked for smoothness utilizing a 16 ft straightedge as described below.

11.4 DATA SUBMISSION, ANALYSIS, AND PAYMENT

The review, analysis, and smoothness pay factor determination utilize ProVAL software. The Contractor must submit formatted ProVAL files for each profile trace, in accordance with ITM 917, by following the steps outlined in the **IRI Field Guide** and **IRI Field Guide for ALR**, both of which are available on the Department's website. The Contractor's submitted ProVAL files shall include two components:

- <u>Smoothness Mean Roughness Index, MRI, analysis for each 0.1-mile section of each profile</u> – utilizing ProVAL's Ride Quality Module as described in the **IRI Field Guide**, and

- <u>Smoothness IRI analysis for Areas of Localized Roughness, ALR</u> – utilizing ProVAL's Smoothness Assurance Module, SAM, as described in the **IRI Field Guide for ALR.**

The MRI is determined for each 0.1-mile section of pavement by taking the average of the IRI for the two wheel paths. IRI is the roughness index for an individual wheel path. For the overall smoothness incentive, MRI is the method of analysis as described in the **IRI Field Guide**.

For ALR's, the IRI for each individual wheel path is utilized, as described in the **IRI Field Guide for ALR**. Additionally, MRI pay factors for smoothness are required to be determined prior to any smoothness correction described in the sections below.

After the Contractor completes the initial analysis, all data files collected by the inertial profiler and all data files created during ProVAL analysis are required to be submitted to the PEMS in a timely manner. The PEMS will review the submitted ProVAL files utilizing the **IRI Field Guide** and **IRI Field Guide for ALR** located on the Department's website under the **IRI Information** heading. The PEMS will utilize the results from the ProVAL analysis to generate smoothness pay factors based on the **IRI Payment Adjustment Spreadsheet**. The PEMS will notify the Contractor of the results within seven days or provide notification of any issues with the files that require modification. After accepting the submitted files and completing smoothness pay factor and payment determination, the PEMS will place all completed files in the ProjectWise Intelligent File Cabinet for the contract within seven days. All pavement smoothness files are to be placed in the Pay Items Documentation folder of Intelligent File Cabinet.

Upon completion of analysis and payment, the Contractor is required to complete the **Contractor IRI Data Submission Form** by selecting the link under the **IRI Information** heading within the

Department's Construction Information website. This survey form is required to be filled out for all IRI Inertial Profiler data collection performed on PCCP or HMA final surfaces. Submission of this form will automatically notify INDOT Research that contract IRI smoothness work is complete and enable QA reviews, in accordance with ITM 917, on selected contracts each construction season. If the contract has smoothness data collection completed in phases, the Contractor will be required to submit the **Contractor IRI Data Submission Form** for each phase. In accordance with ITM 917, the Contractor is also required to submit raw unfiltered unmodified data files taken directly from the inertial profiler equipment for each lane in each direction and for each status to: iriuploads@indot.in.gov.

11.5 REVIEWING AND DETERMINING CORRECTIVE GRINDING AREAS

Corrective grinding may be required for areas exceeding the thresholds established for overall smoothness on each 0.1-mile section or for areas exceeding the thresholds established for ALRs. The PEMS should review the **IRI Pay Adjustment Spreadsheet** for the appropriate pavement material for each 0.1-mile section and determine which sections exceed the specified thresholds.

- Type A, HMA pavement sections with an MRI over 90 in/mi will require corrective grinding.
- Type B HMA pavement sections with an MRI over 110 in/mi will require corrective grinding.
- All PCCP pavement sections with an MRI over 90 in/mi will require corrective grinding.

Review the ALR report from ProVAL to determine each ALR location which exceeds the specified thresholds.

- Type A HMA pavement with an ALR exceeding 160 in/mi IRI or
- Type B HMA pavement with an ALR exceeding 170 in/mi IRI will require corrective grinding.
- All PCCP pavements with an ALR exceeding 160 in/mi will require corrective grinding.

Prior to beginning corrective grinding work, the Contractor should perform a grinding simulation in the ProVAL software to determine if the problematic area can be corrected with a 1/4 in. maximum grinding depth at any location. If a 1/4 in. maximum grinding depth will not resolve the issue, the results of the grinding simulation will need to be reviewed alongside the specified requirements to determine whether the ALR may remain in place or require full depth removal.

Appendix A of the **IRI Field Guide** has guidance on confirming the IRI data provided by the Contractor and making determinations about grinding. The PEMS should review this document and verify the Contractor's data prior to accepting and allowing any corrective action to proceed on the jobsite.

11.6 USE OF STRAIGHTEDGE FOR AREAS EXEMPT FROM INERTIAL PROFILER

The Contractor shall furnish and operate acceptable 16 ft straightedge for areas exempt or excluded from Inertial Profiler requirements. The exempt and excluded areas are defined in the SS and in ITM 917. Exempts and exclusions include such areas as bridges, railroads, lanes shorter than 0.5 mi, lanes with speed limits less than or equal to 45 mph, tapers, ramps, shoulders, and turn lanes. In accordance with the requirements, the Contractor has the option of electing to operate their approved Inertial Profiler under the mode of simulating the 16 ft straightedge for these exempt or excluded areas, as long as the equipment is operated within the manufacturers speed range with appropriate lead-in and lead-out distances, which may require additional MOT setup by the Contractor.

11.7 IRI ONLINE TRAINING

For additional information on how high-speed Inertial Profilers operate and further details on the IRI index, the Department has produced an introductory course on the topic. The course is available within SuccessFactors under the learning tab. The course can be located by entering the title “IRI Introduction Course” in the search box under “Find Learning” and then selecting to start the course.

Section 12:

Undersealing with Asphalt Material

SECTION 12 – UNDERSEALING WITH ASPHALT MATERIAL

12.1 GENERAL

Undersealing consists of drilling holes and pumping hot asphalt beneath faulted and "pumping" pavement slabs. The fundamental purpose is to provide a uniform bearing for the pavement by filling any cavities and voids that exist between the slab and subgrade. This operation will also seal the cracks and joints from underneath the pavement. Undersealing should not be used in areas where the subgrade is providing satisfactory support for the slab or to re-adjust adjacent slabs into vertical alignment.

12.2 LOCATING AREAS FOR UNDERSEAL

Well in advance of the undersealing operation, the PEMS must mark the locations on the pavement where holes are to be drilled. At the same time, record the station number and lane, right or left, for contract payment documentation. The location and spacing of the drill holes requires consideration and forethought. In the absence of previous experience, this aspect should be reviewed in detail with the AE.

Cracks and joints which are "pumping" are more easily discernible during the wetter months of spring. Their detection becomes more difficult during dryer summer months. Immediately following a heavy rain, or as soon thereafter, as the pavement becomes dry, is an ideal time to observe any tendencies toward slab pumping movement. Pumping pavement is identified by water and fine soil particles being pushed through the joints or from beneath the slab at the pavement edges. Another indication of slab movement is discoloration or evidence of soil staining at the joints and edge of pavement caused by the pumping action.

12.3 PREPARATION FOR UNDERSEALING

Prior to the start of the undersealing operation, the Contractor is required to fill or repair all holes, low areas, and displaced areas in the shoulders immediately adjacent to the pavement to be undersealed. These repairs should be made with appropriate materials and to the elevation of the pavement's edge. All shoulder areas adjacent to areas to be undersealed shall be compacted prior to the start of the underseal operation.

Holes no larger than 1 1/2 in. in diameter should be drilled in the center of the traffic lane and from 30 to 36 in. from any transverse crack or joint. This distance will vary according to the condition of the crack or joint. At well-interlocked cracks one hole placed relatively close may prove sufficient, while an open joint may require a drill hole on both sides as much as 36 in. in each direction from the joint. Establishing typical patterns is impractical because no two jobs are identical, and the satisfactory spacing of holes is often a case of trial and error until a pattern providing the desired results is established.

The same is true for the transverse location of the hole. Begin by placing the hole in the center of the lane and make note of which side of that lane the material creeps out of first, the edge of the pavement or longitudinal joint. If material is consistently creeping out of one side first, the location of the holes should be moved away from that side to ensure complete filling of the void across the lane width. This will require experimenting with a number of holes at the beginning of the operation. Care should be taken to not allow the drill bit to penetrate into the subgrade. This may open a new path for the asphalt material to flow into the underlying subgrade.

12.4 ASPHALT PUMPING

The asphalt pumping operation should be performed at the minimum pressure that will accomplish the desired results. An excessive pressure will contribute to waste of asphalt by movement of the material into the shoulder and opposite lane, and excessive jacking of slabs. It can also increase the potential for “blowouts” in the shoulder, at the pavement edge, and along a joint or crack. The PEMS should be certain that all personnel on the operation are properly instructed concerning the dangers associated with hot asphalt being applied under pressure, cautioning them to be alert to blowouts and broken delivery lines. Non-essential personnel should remain outside the immediate area of the operation during times when the material is being pumped. Long sleeves, face protection and gloves should be worn by those required to be within the immediate area of the pumping operation.

The undersealing measuring device or gauge should be used to monitor the movement of the slab at each hole. Depending on the type of pavement being undersealed, pumping should cease when one of the following conditions are met:

	Conditions		
Type of Pavement	Slab Lift	Pumping Time	Leak/Blowout
Jointed Concrete	1/4 in.	15 seconds	Leak/Blowout
Continuous Reinforced	1/8 in.	12 seconds	Leak/Blowout

The gauge must be placed on an adjacent area and perpendicular to the centerline of the pavement being undersealed. The gauge must be monitored during the pumping operation to detect slab movement. Each hole may require a different amount of underseal material and must be monitored as outlined above for the applicable treatment.

This gauge cannot be used on the center lane of a three-lane roadway due to the requirements for placing the gauge. The center lane should be undersealed first and usually for the pumping time indicated above unless extrusion occurs.

After pumping is complete, a wood plug must initially be driven into the hole. When the pumped material has hardened, the initial plug is removed and a hardwood plug is driven flush with the surface of the pavement. This installation of the hardwood plug should be in accordance with the SS and contract documents in both size and manner of installation.

12.5 SAFETY

Safety measures for the undersealing operation cannot be overemphasized. Keep in mind that hot asphalt material is being pushed under the pavement at high pressure. Flexible lines and connections are subject to mechanical failure. In addition, “blowouts” at surface cracks, pavement joints and edges, and in the shoulders are common occurrences. In view of all these facts, it is advisable for all non-essential personnel to stay clear of the operation. Those personnel inspecting the operation should stay clear of potential hazardous locations and stay up-wind of the operation to lessen the potential for exposure to hot asphalt material that might be blown during removal of the nozzle from the core hole. The PEMS should see that all Department assigned personnel dress appropriately for the operation and observe proper precautions.

Section 13:

Hot Mix Asphalt, HMA, Pavement

SECTION 13 – HOT MIX ASPHALT, HMA, PAVEMENT

13.1 INTRODUCTION

The Department has SS for both QC/QA HMA (Section 401) and non-QC/QA HMA (Section 402) mixtures. The major differences between the two specifications are the acceptance and documentation requirements.

The Contractor is responsible for designing the asphalt mixtures in accordance with the SS. All DMFs are reviewed for compliance with the SS.

These instructions apply to both 401 and 402 HMA pavements unless specifically indicated otherwise.

13.2 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

The Contractor is responsible for QC of all phases of asphalt operations. The operational and quality control tolerances are defined in 401 and 402, as appropriate.

To ensure the Contractor's QC procedures provide a finished product that is within the defined tolerances, the Department follows QA procedures for 401 pay items. These procedures are designed to provide inspection of the Contractor's processes and random sampling of the material placed. The QA process is completed with the conclusion of testing of samples by DMT personnel.

The Contractor provides a Type D certification, in accordance with 916 of the SS, as the basis of acceptance for 402 pay items. No sampling of asphalt mixtures is required in conjunction with 402 HMA work.

13.3 QUALITY CONTROL PLAN (QCP)

The contract specific steps the Contractor intends to use for their paving operations are included in their QCP. The QCP must be prepared in accordance with ITM 803 and submitted by the Contractor in accordance with 401.02.

The PEMS must review the QCP and approve it if the plan addresses all appropriate ITM 803 checklist items in a clear and complete manner. The intent of the review is to verify that all checklist items are addressed and not to incorporate the reviewer's personal preferences into the QCP. If there are any questions regarding QCP contents, the AE and DMT personnel are available resources. The Contractor cannot begin paving operations until the QCP is approved, so review of the QCP must be a high priority. Reject the QCP if it does not address the checklist items. Return the rejected plan to the Contractor as soon as possible with a clear description of the deficient aspects. A primary review criterion for the QCP is whether the plan addresses all contract specific issues related to the paving operation. A generic "cut and paste" QCP is not appropriate for contracts on which specific problems are anticipated.

Once the QCP is approved, enforce it to the same extent as any other contract document. If the Contractor is performing work contrary to the QCP, attempt to resolve the discrepancy as soon as possible. If the issue cannot be resolved with the Contractor, notify the AE. It is appropriate for the paving operation to be suspended for the Contractor's failure to follow the contents of its QCP. However, suspension of the paving operation should be handled in accordance with guidelines established within the District.

Once a QCP is approved, the Contractor can propose changes to the approved plan by submitting an addendum. The addendum must include a complete description of the proposed change, including any element of the approved plan that is modified or deleted. Review the addendum and approve it as quickly as possible. If the addendum is incomplete compared to the ITM 803 checklist, reject the addendum and note the deficiencies in the reply to the Contractor. The most recently approved version of the QCP remains in effect until an addendum is approved. Do not allow implementation of the proposed change until the addendum is approved. Once an addendum is approved, attach it to the original QCP. Approved addenda have the same standing as any element of the originally approved QCP.

If a situation which is not covered by the QCP arises, work with the Contractor to determine an appropriate solution within the SS to resolve the problem. If a mutual solution cannot be determined, contact the AE. The AE has resources at DMT, M&T, and CM available to resolve the issue. After a solution is reached, require the Contractor to document the agreement by submitting an addendum to the QCP. If the solution is documented correctly, approve the addendum and attach the approved addendum to the original QCP. If the addendum requires correction or additional clarification, reject the addendum and return it to the Contractor with a clear description of the deficiencies with the addendum.

13.4 QUALITY ASSURANCE PROCEDURES (SECTION 401)

QA procedures are performed by the Department to verify that the Contractor's work meets the requirements of the SS. QA procedures require plate samples of the mixture to be taken from the course after placement by the paver. The DMT "hub" acts as a central collection point for all HMA acceptance samples. The hub personnel pick up and/or receive all HMA samples in the District. The hub personnel check sample input information to ensure that Construction has entered all the correct information. If there is a discrepancy with the entered information, District hub personnel contact the appropriate Construction contract field staff to correct the discrepancy. The samples are then transported to District's M&T laboratory facilities for a battery of tests to determine the following volumetric properties:

- Binder Content
- Volume of Effective Binder, V_{be}
- Air Voids.

In addition, cores are taken to determine the in-place density of each compacted mixture.

M&T personnel will enter QA test results into Pay Wizard for mixture properties and density. All QA adjustments for QC/QA HMA mix properties and density are available and stored in the HMA Pay Wizard application. Automatic emails are sent to the PEMS from Pay Wizard to notify them that the QA test results are available. Two exceptions include QA test results for stone matrix asphalt, SMA, samples and open graded, OG, samples, each of which are currently sent to the PEMS by DMT personnel.

A material Sample ID is used to identify a material sample taken from and submitted by the field. It is defined by a 12 digit number beginning with the capital letter "**R**".

Example of a Sample ID = **RYYDSSSS12345**
where:

R =	Report (must <u>always</u> be a capital "R")
YY =	Last 2 digits of the current year
D =	District number (1 through 6), or Materials and Testing (7), or Toll Road (8)
SSSS =	4 digit submitter number for the individual submitting the sample
12345 =	Unique sequential number for the sample. Generated by the PEMS for the particular contract.

Pavement smoothness is another topic which requires QA review. On contracts which include the pay item for Inertial Profiler, HMA, the Contractor is responsible to furnish, calibrate, and operate a high-speed inertial profiler, certified by the Department, for the measurement of longitudinal profile on the mainline traveled way and adjacent acceleration and deceleration lanes. For comprehensive information on Pavement Smoothness utilizing the IRI index and Inertial Profiler equipment refer to Section 11 of these Instructions.

On contracts that do not include the Inertial Profiler, HMA pay item, the 16 ft straightedge will be used to verify longitudinal profile of the constructed pavement. For these situations, smoothness is checked using a 16 ft straightedge supplied and operated by the Contractor.

Regardless of the instrument used to measure the longitudinal profile, a 10 ft straightedge is used to verify the slopes transverse to the mainline direction of traffic. This includes longitudinal profiles of all public road approaches, commercial driveways, and residential driveways.

13.5 MATERIALS

All asphalt mixtures must be supplied by a certified HMA plant in accordance with ITM 583.

There is a standardized format that provides information about the type of material required for 401 pay items.

The following is a sample QC/QA HMA mixture pay item:

QC/QA-HMA, 3, 58E-28, Surface, 9.5 mm
where:

The **"QC/QA-HMA**" portion of the pay item is read as "Quality Control, Quality Assurance, Hot Mix Asphalt".

The number **"3"** indicates the ESAL category for the mixture. The ESAL category reflects the truck traffic anticipated for the roadway. Higher ESAL category numbers indicate higher anticipated truck volumes. Higher ESAL category mixtures require more durable aggregates to carry the additional loads.

The number **"58"** indicates the PG binder high temperature grade that is required for the mixture. This number reflects the high pavement temperature, in Celsius degrees, at which the binder is expected to perform. In this case the high pavement temperature is expected to be 58°C (136°F).

The letter "**E**" designation after the binder identification indicates the traffic loading designation. Typical designations include:

- "**S**" for Standard grade which represents a neat binder with no grade bumps,
- "**H**" for Heavy grade indicating heavy or slow-moving traffic, and
- "**E**" for Extreme grade.

The number "**-28**" represents the low temperature value, in Celsius degrees, at which the binder is expected to perform. In this case, the low pavement temperature is expected to be -28°C (-18°F).

The word **"Surface"** indicates the mixture type. Base, intermediate, and surface courses are the mixture types typically utilized in pavement. Base courses are usually placed on treated subgrades, but occasionally they are used for structural (three or more lifts) overlays and are placed on a milled existing pavement. Intermediate courses are typically placed on underlying base courses or a milled pavement for functional (two lifts) overlays. Surface mixtures are usually placed on underlying intermediate courses or on a milled pavement surface in "mill and fill" applications.

The term **"9.5 mm"** identifies the nominal aggregate size utilized in the mixture. The available nominal aggregate sizes are 4.75 mm, 9.5 mm, 12.5 mm, 19.0 mm, and 25.0 mm. Mixtures with larger nominal aggregate size designations have larger particle sizes in their gradations. The maximum particle size in a mixture is larger than the size in the nominal aggregate designation. Refer to 401.05 of the SS for gradation range information.

HMA mixes for 402 pay items shall include transverse rumple strips, temporary pavements, and wedge and level courses. The mixture type specified for temporary pavements and wedge and level courses is required to be in accordance with 402 of the SS.

13.6 DESIGN MIX FORMULA (DMF)

The DMF is the process by which the Contractor conveys their design for each HMA mixture to DMT. ITM 583, Certified Hot Mix Asphalt Producer Program, is the primary document that includes requirements for the development of a DMF. DMT personnel are a resource to answer questions regarding DMFs.

The DMF includes the following information related to the mixture design:

- Producer (Contractor)
- Plant Location
- Material Identification/Sources-PG binder, coarse and fine aggregates
- DMF number
- Applicable ESAL Categories
- Mixture Course and Nominal Aggregate Designation
- Gradation Information
- Specific Gravity
- Lab and Plant Mixture Temperatures
- RAP/RAS Content
- Volumetric Properties
- Mixture Adjustment Factor, MAF
- Other Miscellaneous Design Information.

A DMF must be accepted by the DMTE and assigned to an appropriate CLN by the Contractor prior to paving. The Contractor cannot use an HMA mixture on a contract until a DMF has been assigned a mixture number by the DMTE. The mixture number will be assigned for each calendar year and is not intended to construe acceptance. DMF numbers are automatically generated by DMF Entry after review and approval by the districts, based on the year and plant. All DMFs for QC/QA HMA are available and stored in the DMF Entry application. This can be accessed through the INDOT Technical Application Pathway (ITAP).

At the preconstruction conference, the PEMS must ask the Contractor which DMF are planned to be utilized on the contract. Additional questions include which alternate plants are intended to be used on the contract and whether the required DMF has been obtained for mixtures produced at those plants. Establish lines of communication between the Contractor and the DMT representative at the meeting to reduce the likelihood of misunderstandings between the parties regarding material sources and material sampling requirements for 401 mixtures. Make arrangements with the DMT representative regarding transporting QA samples.

The PEMS must become familiar with each DMF number as well as the PG binder content, MAF, and pay item related information. Each mixture weigh ticket brought to the contract site must include information in accordance with 109.01(b). The DMF number is included in that list of required information. Omission of any of the required information is sufficient cause for the load to be rejected. Discuss this at the Preconstruction Conference. When asphalt mixtures arrive at the site, it will be necessary to verify that the DMF number listed on the ticket is appropriate for the mixture associated with the current paving operation.

An explanation of how a DMF number is generated by DMF Entry is indicated below:

- A DMF is a 9-digit number. An example would be **R253323001**:
    - Beginning letter “R”
    - First 2 digits = Sample Year (e.g., 25 for 2025)
    - Next 4 digits = Plant number (e.g., 3323 = Milestone - Lafayette Plant)
    - Final 3 digits = Unique mix design number (e.g., 001).
- Approved DMFs are available through the DMF Entry application on ITAP.

13.7 MATERIAL SAMPLING AND TESTING (SECTION 401)

Material sampling for QC/QA HMA pay items is very important because the pay items include a QA Adjustment pay factor. The pay factor either provides the Contractor with additional compensation for situations where the QA test results exceed SS requirements or provides the Department a credit if the test results fall short of these requirements. Sampling must be performed in accordance with ITM 580.

The PEMS must verify that the Contractor is performing QC sampling and testing in accordance with the approved QCP. Because the Department is responsible for QA testing, the PEMS must determine the random QA sample locations, witness the material sampling performed by the Contractor’s Certified Technician, and take immediate possession of the samples.

In promoting safety during QA sampling, the PEMS must provide the Contractor with an appropriate advance notice of the QA sample location. This advance notice enables the Contractor to coordinate necessary personnel, notify the paving train and haul trucks, and allow for the accurate and secure placement of sample plates on the roadway.

For base and intermediate mixtures, which typically require larger quantities due to their foundational nature, the PEMS should provide advance notice of an upcoming sample in approximately 200 tons, or about 10 trucks. This lead time helps to ensure that the Contractor can adequately prepare for the samples, minimize disruptions, and maintain safe working conditions.

On the other hand, surface mixes, which generally cover more area per ton, require less lead time. A notice of approximately 100 tons, or 5 trucks, should be provided for surface mixtures. This smaller lead tonnage notification should be adequate to ensure that plates are safely placed without interrupting the paving process unnecessarily.

District hub personnel pick up and/or receive all HMA samples in the District and then send them to M&T for testing as described earlier in this section. Lab personnel run the required tests on the samples to verify conformance to 401 requirements. The mixture properties determined by the QA testing process include binder content, V_{be}, and air voids. In addition, after the paving operation has been completed, cores are taken to measure in-place density. The smoothness of the pavement surface may be measured by the inertial profiler to complete all the pay factors for the individual QC/QA HMA pay items.

After material samples are taken from the newly placed pavement course, verify that the plate sample locations are satisfactorily repaired by the Contractor.

After density cores are taken from the pavement, the PEMS must verify that Contractor personnel mark the course for which the density is to be determined on the core and check that all core holes are filled with asphalt material or rapid setting bridge deck repair material within one working day after the cores are taken.

It is important to properly document the plate sample boxes and cores. Be sure to include the sample ID number, which is the most important part.

After the sample has been obtained, the sample location will be recorded. If the sample is obtained by the Contractor for the Department's acceptance testing, the Contractor representative who obtained the sample and the Department representative who witnessed the sample being taken will be identified on the transmittal information. The following information shall be on all box ends for plate samples and core cylinder containers:

1. A/B sample (A1, A2, A3, B1, B2, Core 1, Core 2)
   where:
   A1 = sample used for MSG and binder content
   A2 = samples used for gyratory specimens
   A3 = samples to determine aggregate bulk specific gravity
   B1 = backup sample for MSG
   B2 = backup sample for gyratory specimens
   Core 1, Core 2 = Core samples for density or thickness.
2. Contract Number
3. DMF/JMF Number
4. Item (CLN) Number
5. Lot/Sublot
6. Material Description: Size, Course, ESAL Category, PG Grade
7. Sample Date
8. Sample ID Number.

The required sampling frequency is based on lots and sublots, in accordance with the SS. It is necessary to keep track of the quantity of each QC/QA mixture/DMF combination as it is being placed so the appropriate number of samples are obtained from the proper locations. Sample locations are determined randomly based on procedures within ITM 802.

It is necessary to track the quantity of each QC/QA mixture/DMF combination as it is being placed to determine the physical limits of each lot and sublot. The PEMS must develop their own system for tracking lots and sublots. Record the beginning and ending stations and lane designation for each lot and sublot in a Daily Work Report for the appropriate date. If the paving operation changes lanes prior to reaching the end of a lot and sublot, record the ending station and lane designation for the first lane and the beginning station and lane designation for the new lane in a Daily Work Report for the appropriate date.

Partial sublots with a quantity of 100 tons or less are considered to be part of the previous sublot and no additional sampling or testing is required. Partial sublots with quantities greater than 100 tons are considered to be a full sublot and all sampling and testing normally associated with a sublot is required. The PEMS should notify the DMTE when a partial sublot is utilized on a contract.

On contracts that require the placement of additional mixture the following year, terminate the sublot at the end of each construction season and notify the DMTE of the termination. In addition, if production of an individual QC/QA HMA mixture will be halted due to construction phasing or other similar reason, coordinate with the Contractor and the DMTE to determine whether an agreement can be made to terminate the sublot at the temporary end of production. This agreement may be advantageous should a failed materials issue arise because all the mixture subject to the Failed Materials Committee action would be contained within one area or construction phase. If either the Contractor or DMTE does not agree to the early termination of the sublot, the PEMS should include the mixture previously placed upon the resumption of production for the original sublot.

13.8 MISCELLANEOUS MIXTURES (SECTION 402)

HMA mixtures within 402 of the SS include those used for the following miscellaneous applications:

- transverse rumble strips,
- wedge and level courses,
- temporary pavement, and
- curbs.

When used for these special applications, some requirements for HMA materials used in typical paving operations do not apply. Conversely, there are additional restrictions that apply to these special applications that are not applicable for typical HMA pavement mixtures.

13.9 PAVER SEGREGATION PREVENTION FEATURES

The Contractor is required to submit documentation indicating each paver utilized on the contract has been manufactured or retrofitted with equipment designed to prevent segregation of coarse aggregate during the paving operation. The documentation requirements are outlined in 401.10 and also outline additional requirements related to specific pavers proven to be susceptible to segregation issues. The Contractor is also required to demonstrate that all required modifications have been implemented on each paver used.

Typically, these features mitigate segregation caused by the paver's gearbox. The segregation usually occurs in the middle of the course and, in most cases, eventually results in a longitudinal crack on the finished pavement.

13.10 SUBGRADE TREATMENT OR EXISTING PAVEMENT SURFACE PREPARATION REQUIREMENTS

Prior to constructing a full depth pavement or widening adjacent to an existing pavement, the subgrade on which the base mixture is placed must be treated in accordance with 207. Refer to the Typical Sections or the Standard Drawings for the type of subgrade treatment required.

Prior to placing an overlay, the existing pavement surface must be properly treated. Typically, existing asphalt surfaces are milled prior to placement of the overlay. Existing concrete pavements are typically milled, rubblized, or cracked and seated prior to overlay placement. Rubblized concrete pavement surfaces require the application of prime coat, in accordance with 405, prior to overlay placement. All other existing asphalt or concrete pavement surfaces require tack coat to be applied prior to placement of the overlay, in accordance with 406. When spray pavers are utilized, emulsion is required to be applied in accordance with 409 and the specific Laydown Equipment option.

13.11 WEATHER LIMITATIONS

There are two weather limitations pertaining to 401 QC/QA paving operations discussed in 401.13. The first pertains only to mixtures with planned lay rates less than 138 lb/syd. This stipulation discusses the air temperature and the underlying surface temperature requirements for mixes meeting this lay rate. The second limitation listed states that no mixture is to be placed on a frozen subgrade. In situations where late season paving is required, the PEMS should contact the AE for guidance.

Additional weather constraints apply for 402 mixtures. Refer to 402.12 for these limitations.

If any portion of the paving operation is performed during a rain event, verbally notify the Contractor that any additional mixture placed is at the Contractor's risk. The verbal notification must be followed up with written notification. Include the correspondence in the project file. After conclusion of the rain event, hold an inspection of the affected pavement with the Contractor as soon as possible. Mark all areas of pavement that are found to require repair or replacement. If there is any disagreement regarding the scope of corrective action, the PEMS contact the AE.

In situations where a rain event occurs while mixture is being placed on a treated subgrade, suspend the paving operation immediately if the subgrade deforms unacceptably while loaded by trucks, paver, or other equipment included in the paving train. For this purpose, unacceptable deformation is defined as deformation requiring corrective action if identified during a proofrolling operation. Note the suspension in the Engineer's Diary and notify the AE.

13.12 SPREADING AND FINISHING

As mixture is delivered to the site, spread by the paver, and compacted by rollers, the PEMS or HT must pay attention to and notify the Contractor when problems occur with the following:

- Maintenance of traffic associated with paving operation, particularly at intersections and driveway approaches.
- Performance of the subgrade or underlying pavement while being loaded by trucks and paving equipment.
- Application of prime coat or tack coat as appropriate.
- Defects in the course behind the paver—segregation, flushing, roller marks, petroleum spills, etc.
- Correct placement of the course in relation to depth and width checks as well as yield calculations.
- Alignment of paver.
- Temperature and compaction requirements if density is not controlled by cores.
- Use of paver extensions.
- Allowable dropoffs and the matching of existing lanes if paving is performed under traffic.
- Equipment used for placement of mainline and shoulder mixtures.
- Roller operation.

The PEMS must verify that the Contractor has adequate work zone signage and flaggers available to enable trucks hauling material to the site to enter and leave the paving train in a safe manner. When paving is being performed adjacent to traffic, it may be necessary for the Contractor to employ additional flaggers or signs as the paving train approaches intersections or other site-specific locations. If there are deficiencies in the Contractor's work zone traffic control, suspend the paving operation immediately until corrective action is taken. Document the suspension of work in the Engineer's Diary and notify the AE.

If the mixture is being placed on a treated subgrade, verify that the subgrade does not show unacceptable deformation under paving train loading. Although proofrolling is required prior to paving in accordance with 207.03, it is necessary to monitor the performance of the subgrade during the paving operation. If the subgrade deforms in a manner that would require corrective action during a proofroll operation, suspend the paving operation until the appropriate subgrade repairs are made. Document the suspension of work in the Engineer's Diary and notify the AE. For situations where the mixture is being placed on a milled existing pavement surface, verify that the milled surface is not raveling during the paving operation. If raveling is occurring, contact the AE for additional guidance.

In situations where prime coat or tack coat is required in accordance with 405 or 406 respectively, verify the material has been applied at the appropriate rate, has no streaking, and has uniform coverage. Common deficiencies in application of prime or tack coat include unacceptable coverage due to improper or clogged nozzles, improper spray bar height or width on the distributor, or inappropriate distributor speed or mechanical problems with distributor equipment.

Inspect the course behind the paver periodically and note any defects requiring correction. Besides segregation and flushing, defects include areas where petroleum products or hydraulic fluids are spilled. These liquids damage asphalt pavements. Petroleum products are often used by the Contractor to clean hand tools associated with the paving operation. Do not allow open containers of any petroleum product to be placed on the paver or other pieces of paving equipment. Contamination defects can also be introduced to the course by leaking hydraulic fluid hoses on the paver or other paving train equipment. It is usually necessary to remove the contaminated mixture from the course and replace it with new material.

The PEMS or the HT must verify that the Contractor is placing the course to the appropriate depth and width. Width checks are especially important when a base course is placed on a treated subgrade. If these courses are placed too wide, overlying mixtures will be placed too wide as well. Perform depth and width checks approximately every 500 ft. Check the yield associated with five to ten trucks at least twice a day. This is done as follows:

- Determine the approximate beginning station associated with the first truck.
- Determine the approximate ending station associated with the last truck.
- Calculate the weight of the mixture placed from the trucks by adding the weight from individual weigh tickets.
- Calculate the area covered by the mixture from the trucks by using the difference between the stations to determine the length and the average paving width accounting for the edge slope for the mixture on either or both edges as appropriate.
- Calculate the in-place lay rate of the course by dividing the weight of the mixture by the area over which it is placed.

Compare the calculated actual placed lay rate to the target lay rate for the mixture. The target lay rate is obtained from the planned lay rate of the appropriate typical section or Standard Drawing multiplied by the Mix Adjustment Factor, MAF. If there is more than a five percent difference between the calculated actual placed rate and target lay rate, notify the Contractor that appropriate corrective action must be taken.

The PEMS or the HT must periodically confirm that the paver is progressing in a straight manner along the subgrade or existing pavement to be overlaid. Pavers that are overloaded or experiencing mechanical problems can deviate from an intended straight path. If the paving is taking place on a steep grade, it may be necessary for the trucks to remain unhitched from the paver and dump partial hopper loads to allow the paver to remain on the intended alignment path. To help maintain consistent placement of the course, it is necessary for the paver to move as straight as possible.

If density of a 401 QC/QA mixture is not controlled by cores, additional requirements are included in 401.14.

Verify the mixture temperature immediately behind the paver and check that the paver maximum speed is not exceeded. It is not necessary to check mixture temperatures or paver speeds for other QC/QA HMA mixtures.

Verify the paver operator is not using hydraulic extensions in situations where a constant paving width is being placed. It is permissible to use the hydraulic extensions at tapered paving locations.

If the paving is being performed under traffic, verify the Contractor is matching adjacent lanes in accordance with 401.14, when applicable.

Mainline lanes and shoulders which are 8 ft and wider must be placed with equipment employed with automatic grade and slope controls, in accordance with 409.03. Essentially, this requires that a paver be used in these situations. Verify that the Contractor's equipment meets this requirement. Shoulders that are narrower may be placed with a widener.

Since 402 mixtures are accepted by certification instead of testing in-place, there are specific requirements for 402 mixes that do not apply to 401 materials.

The primary differences are:

- Additional spreading and finishing requirements such as:
    - maximum paver speed,
    - temperature requirements based on the DMF mixing temperature,
    - requirement for tarp protection for HMA mixes being hauled to the contract site, and
    - wedge and level course lay rate variances based on the DMF. Refer to 402.13 for additional information.

- The standard roller train compaction requirements based on the number of passes made by rollers of various types, in accordance with 402.15. In addition, the SS include information related to maximum allowable roller speeds, method of compaction, compaction equipment requirements for areas which are inaccessible to rollers, and the emphasis that the finish rolling operation shall leave no roller marks.

- For low temperature paving situations, 402.16 provides additional requirements to ensure proper compaction of HMA materials. These requirements come into play especially during the late construction season when trying to "button up" a contract for the winter.

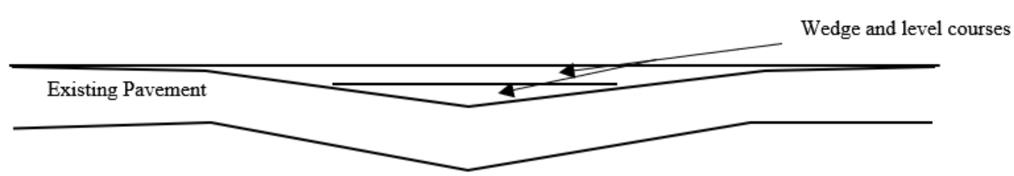
13.13 WEDGE AND LEVEL CONSTRUCTION (SECTION 402)

One of the more common miscellaneous 402 mixture applications is a wedge and level course. A wedge and level application are defined as one or more HMA courses utilized to transition from an existing deficient base profile or section into a more uniform depth QC/QA HMA or HMA course. This newly constructed transition can then be used as a base to construct a pavement with an acceptable profile and section. Common examples of wedge and level courses include:

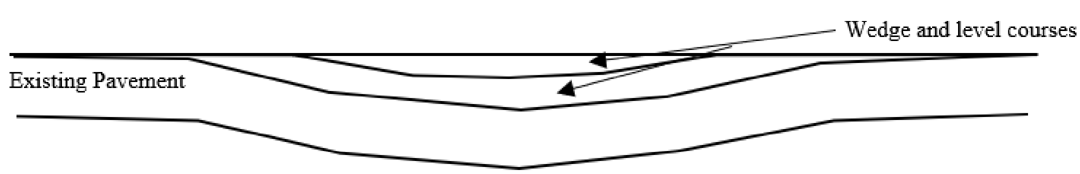
- correcting settlement over or at the approach to a structure,
- establishing the proper crown on a tangent section of roadway,
- correcting a deficient superelevation on a curve,
- correction of wheel path rutting, and
- construction of an improved section where the existing pavement is badly distorted.

Ordinarily, the quantity estimated for these purposes will be indicated in the contract or plans and will vary according to the condition of the road to be resurfaced.

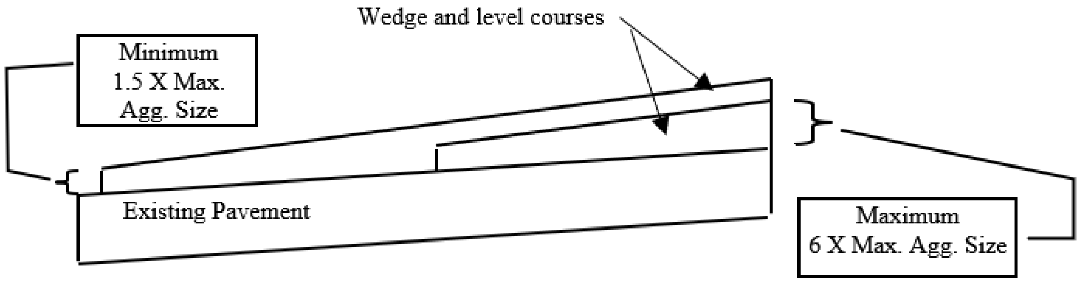
The **correct** method of longitudinally wedging a dip or settlement in an existing pavement is shown below:



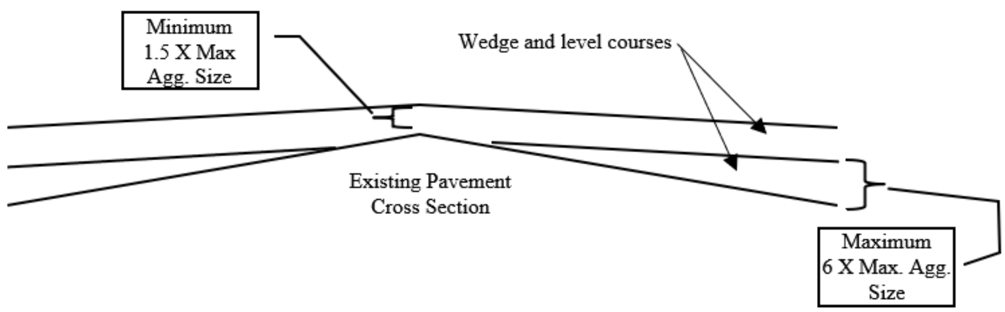
An example of an **incorrect** method of longitudinally correcting a dip or settlement in an existing pavement is shown below:



The number of wedge courses necessary to construct a desired superelevation on a curve is dependent on the maximum size aggregate used in the mixture and the total depth to be placed.



Wedges may also be used to reestablish a crown on a deficient tangent roadway. Again, the number of wedge courses necessary to rebuild the crown depends on the total depth of the wedge to be constructed and the maximum size aggregate in the mixture.



If an undistributed quantity of HMA wedge and level mixture is included in the contract, the PEMS should inspect the existing pavement to determine the limits for wedge and level construction and mark them on the pavement. After this is complete, compare the quantity to the plan quantity for the HMA wedge and level mixture pay item. If the proposed quantity resulting from the layout overruns or underruns the plan quantity by more than five percent, contact the AE for additional guidance. The AE should contact the PM and request a recommendation regarding the resolution of the potential overrun or underrun funding and scope.

13.14 JOINT CONSTRUCTION

Proper construction of joints is critical in obtaining the design life of the pavement. Two primary causes of premature asphalt pavement failure are improper longitudinal joint construction and deficient joint density. The PEMS must verify that the longitudinal joint for each course is offset approximately 6 in. from the longitudinal joint of the underlying course. This makes the joint more resistant to infiltration of water and allows for better compaction of the material placed in subsequent courses at the joint.

13.14.1 Longitudinal Joints

HMA and SMA longitudinal joints are required to be treated with either Void Reducing Asphalt Membrane, VRAM, or joint adhesive. These treatments artificially create density by filling in the air voids at the joint. VRAM is typically used for surface joints while joint adhesive is used for intermediate joints. Base courses do not require treatments at the longitudinal joint.

VRAM is placed on top of the existing course, prior to the surface layer. It is centered under the surface's intended longitudinal joint location and migrates upward as the hot surface mix is placed on top. For milling inlay situations or when only half of the joint is exposed, VRAM can be applied at half-width. The adjacent vertical face of the cold joint is also required to be coated with VRAM.

Joint adhesive is placed on the cold joint prior to placement of the adjacent lane. Joint adhesive is required to be placed between the intermediate joints. It must also be used on surface joints in areas exempted from VRAM use as indicated within the plans or SS. It is not necessary for a surface joint to have both VRAM and joint adhesive treatments applied.

13.14.2 Transverse Joints

Transverse joints are required at the end of the day's work, when moving from one lane to another, upon suspension of work for an extended period of time, at paving exceptions, when matching with adjacent pavement sections, and as indicated in the plans. Lapped joints are not permitted for these situations.

If traffic is to be maintained across a transverse joint, the joint must be tapered sufficiently to allow a smooth ride. It is necessary to place paper or other bond breaker material under the tapered pavement to facilitate removal of the taper material prior to resuming the paving operation. When paving resumes at the joint location, the paver should be positioned so that the screed rests approximately over the joint line. After the hot mixture is conveyed into position, sufficient time should be allowed to reheat the joint area before the forward movement of the paver begins. The paver is then advanced ahead of the joint enough to allow the workers to perform the necessary handwork to transition the new material the old. The use of a straightedge throughout this process is of primary importance. Paving should continue only after the joint has been satisfactorily shaped, rolled and finished.

The QCP must address the Contractor's method for constructing these transverse joints. Pay special attention to the method of placing and compacting transverse joints at bridges, paving exceptions, and contract limits. The lower courses are of particular concern because the roller cannot be operated across the joint between the newly placed course and the adjacent existing pavement. These areas require transverse rolling or special compaction equipment.

13.15 COURSE DEFECTS

After completion of the finish rolling portion of the paving operation, the PEMS should review the newly placed course for defects. Segregation, flushing, and pulling or tearing are common defects found in newly placed courses.

Segregation occurs when the fine and coarse aggregates become separated from each other during the hauling or paving operation. Segregated course feature locations where there are primarily coarse aggregate particles with no fines. The appearance is similar to an open graded mixture. There will be other locations within a segregated course where there are few, if any, pieces of coarse aggregate and mainly consists of asphalt coated fines. The appearance is similar to a sand surface. Common causes of segregation include improper loading of trucks, faulty paver auger operation, and situations where a paver is forced to stop because the hopper runs out of mixture. To avoid the paver having to stop, many paving trains include a material transfer device sometimes referred to as an MTD or a "shuttle buggy". Shuttle buggies essentially provide a larger hopper capacity for the paver and permit the paving operation to progress as long as a sufficient number of trucks hauling mixture are available.

Flushed pavements have locations where liquid asphalt collects on the surface of the course. This may result from excess tack coat being brought up through the course, improper mixing of the materials, or too much PG binder in the mixture.

The remedy for segregated courses usually requires removal of the affected areas and replacement with suitable material. Minor areas of segregation can be repaired using a sand seal coat. Larger and more significant flushed pavement areas shall require removal and replacement, diamond grinding, or other fine milling to remove the excess asphalt. Mark all segregated or flushed areas for correction by the Contractor prior to the course being covered by another lift of material or opened to traffic. Corrective action should be in accordance with the Contractor's QCP. If the QCP does not address the repair of segregated or flushed pavements and an agreement on a solution cannot be reached with the Contractor, contact the AE. The M&T, CM, and the Department's Highway and Pavement Design section are all available resources for determining the scope of the required repair.

Another common defect in a newly placed course is pulling or tearing. The course can be torn or pulled by:

- a paver that is traveling too fast
- a paver with a worn screed, or a screed that is not heated properly
- compacted by a roller that is traveling too fast or rolling a mix that is too tender.

Mark all torn areas so they can be repaired by the Contractor prior to the course being covered by another lift of material or opened to traffic. All torn areas must be repaired in accordance with the QCP. If the QCP does not address the repair of tears in the course, contact the AE if no agreement on an appropriate repair can be reached with the Contractor.

13.16 COMPACTION AND DENSITY

For 402 mixtures, compaction is performed in accordance with 402.15. Since cores are not taken to verify in-place density, the PEMS must verify that the Contractor is performing the rolling operation in accordance with the SS requirements.

For 401 QC/QA mixtures, density is one of the properties included in the QA Adjustment calculation. In most situations, it is necessary to take cores to determine the density pay factor.

However, there are exceptions to core density control related to overlays placed on shoulders. The PEMS should refer to 401.16 to help determine whether cores are required for these situations. When cores are not required, the density is assumed to be 94% MSG and the pay factor for that sublot is assumed to be 1.00.

In general, there are three compaction phases:

- Breakdown or Initial Rolling
- Intermediate Rolling
- Finish Rolling.

Breakdown rolling provides the initial compaction of the mix beyond the small amount of compaction provided by the paver's vibratory screed. This initial rolling process helps seat the mix and introduces aggregate interlock. The intermediate rolling process helps further compact and seal the newly placed mixture. Finish rolling is necessary to remove roller marks and other imperfections present in the new course.

There are many aspects of the rolling operation that affect density in the course. Roller speed is one such factor and maximum roller speed requirements for situations where density is not controlled by cores are included in 401.15. Be aware that there are different maximum speeds for static and dynamic rollers.

Density of the newly placed mixture is affected by the way the Contractor rolls the course. Information related to acceptable compaction is included in 402.15. The finish rolling operation should be performed while the mixture is still sufficiently warm to compact. There is no set rule for the timing and spacing of rollers. Mixture properties and atmospheric conditions affect the compaction of the course. During the rolling operation, roller passes should be differing lengths so that the roller is not always reversing direction at the same location. Achieving the highest course density possible is the objective of the rolling operation.

The Contractor must be performing QC testing in conjunction with their rolling operation to maximize the course density while minimizing the rolling effort. Periodically, the Contractor may need to adjust the number of rollers passes, as well as the amplitude and frequency of the vibratory rollers, to achieve density requirements. There should be no roller marks, creases, or other surface defects in a course when the rolling operation has been completed. The approved QCP should include information regarding corrective action for situations where the rolling operation has not achieved satisfactory density results.

Areas that cannot be compacted by a roller must be thoroughly tamped with mechanical tamps or vibrators. Tampers should be operated to achieve a thoroughly and uniformly compacted surface over the entire course. Often the areas requiring tamping methods of compaction are at critical locations. Care must be exercised to avoid over-tamping the mix and creating low spots which allow water to pond.

During the rolling operation surface distresses may develop. Common distresses include waviness, surface cracks, honeycombed texture, shoving, and roller chatter in the surface. Similar to the spreading operation, these distresses may be due to one or more of the following causes:

- Rolling too soon
- Rolling too fast
- Excessive rolling which crushes coarse aggregate
- Turning the roller too abruptly
- Too much slack in the roller drives
- Reversing the roller too abruptly
- Allowing the roller to stand on fresh surface
- Insufficient rolling
- Roller too light
- Mixture temperature
- Mixture composition
- Incorrect vibratory roller frequency or amplitude.

Upon completion of the rolling operation, the course must be protected from vehicular traffic until it has sufficiently cooled (approximately 175°F) to prevent damage from the traffic. The required cooling time varies due to atmospheric conditions.

Urban construction often requires compaction practices that differ from rural paving operations. It is essential to have a good joint seal between the new course and the adjacent curb or curb and gutter. Thorough compaction adjacent to the curb, at intersections, and adjacent to castings is essential to produce quality construction. In addition to the compaction requirements, the finished surface course must match or be slightly higher than the grades of adjacent gutters and castings to ensure proper drainage. In many situations, an improper matching of grades between a pavement surface and an adjacent gutter line or inlet casting can cause water to pond over a significant area. The PEMS or HT must verify that the roller operator does not allow the roller to bridge the mixture placed adjacent to a combined curb and gutter by allowing the roller drum to ride on the gutter pan instead of the mixture.

The SS contain the same density requirements for urban and rural contracts. Achieving the proper density is as important on an urban street as it is on a rural roadway. In many situations, the Contractor will request density requirements be waived when vibratory rollers are turned off due to potential damage to adjacent property or underlying utility facilities. In many situations, proper density can be achieved if the Contractor adjusts the amplitude and frequency associated with the vibratory rollers. However, some Contractors are reluctant to take the time required to determine the appropriate amplitude and frequency combination. Do not waive density requirements without the Department’s Pavement Design or DCM approval.

13.17 SMOOTHNESS

For 402 mixtures, the PEMS must verify the longitudinal profile of the newly constructed course in all mainline lanes and shoulders by using a 16 ft straightedge. Verify smoothness transverse to the direction of traffic on the mainline by using a 10 ft straightedge. The 10 ft straightedge is also used to verify the longitudinal profile of public road approaches, commercial driveways, and residential driveways.

For pavements constructed using 401 QC/QA mixtures, smoothness is a factor to be included in the QA Adjustment. The inertial profiler is the primary instrument that is used to measure pavement smoothness and the IRI is used to analyze and report smoothness results. On contracts which include the Inertial Profiler, HMA pay item, the Contractor is responsible for operating the profiler and submitting all IRI data files for each lane completed on the contract. For comprehensive information on Pavement Smoothness utilizing the IRI index and Inertial Profiler equipment refer to Section 11 of these Instructions.

When the Inertial Profiler, HMA pay item is included in the contract, it is only used to measure smoothness on the lanes which meet all the criteria contained in 401.18 and are not exempted by criteria included in ITM 917. The 16 ft straightedge is used to check longitudinal profile at all other locations. The 10 ft straightedge is used to verify the smoothness of all slopes transverse to the mainline at the same locations as described above for Section 402 pavements.

If there is no Inertial Profiler, HMA pay item in the contract, the 16 ft and 10 ft straightedges are used to check the newly placed QC/QA HMA mixtures as described above and for all non-QC/QA HMA pavements. For these situations, smoothness is not calculated in QA Adjustments. For these situations, smoothness is checked using a 16 ft straightedge supplied and operated by the Contractor.

The Contractor is responsible for furnishing and operating the 16 ft straightedge, while Department personnel are responsible for furnishing and operating the 10 ft straightedge. The Contractor is responsible for providing all traffic control required to operate the straightedge.

Diamond grinding is a common method for correcting bumps and dips which exceed SS limits. In situations where severe low spots have resulted from the paving operation, it may be necessary to grind longitudinally in one or both directions from the low area and wedge with asphalt material.

Areas of grinding do not require sealing with tack coat or fog seal. Sealing these areas can create undesirable friction problems. The appearance of areas of grinding will eventually blend with the surrounding asphalt surfaces.

ITM 917 also includes information regarding areas which are exempt from Inertial Profiler smoothness measurements and how to accommodate partial sections encountered due to contract limits or paving exceptions. Questions regarding these topics should be directed to the AE, DMT, or the District's assigned FE.

The Contractor must indicate their potential methods of corrective action in the QCP. If their QCP does not address proposed methods to correct smoothness deficiencies and no agreement with the Contractor can be reached, contact the AE.

13.18 PAY FACTOR DETERMINATION AND QUALITY ASSURANCE ADJUSTMENTS (SECTION 401)
When a Contractor produces a 401 QC/QA mixture for a pavement or overlay, payment for this work will be made at the contract unit price per ton of mixture delivered to the contract. In addition, these contracts include a QA Adjustment pay item which provides additional payment to the Contractor or a credit to the Department based on the results of the QA testing.

The QA Adjustment Pay Factor may involve reviewing two components. The first component is based on mix properties and density. The second involves the component of smoothness and would only be reviewed if the contract includes the Inertial Profiler, HMA pay item. When the profilograph or the inertial profiler item is present on the contract, the QA Adjustment Pay Factor is based on the profile index or IRI results measured after the full depth pavement or overlay is constructed.

All QA adjustments for QC/QA HMA mix properties and density are available and stored in the HMA Pay Wizard application. This can be accessed through the INDOT Technical Application Pathway, ITAP.

All QA adjustments for QC/QA HMA smoothness are stored in the Intelligent File Cabinet in the ProjectWise Intelligent File Cabinet system within the Pay Items Documentation folder.

For all dense graded mixtures with a pay item/DMF combination quantity **greater than or equal to one lot**, the pay factors are determined based on a percent within limits, PWL, basis in accordance with 401 of the SS. The final PWL Acceptance results for each pay item/DMF combination includes composite pay factors for each lot based on mixture properties and density. The PEMS uses this information to determine the pay factors and the QA Adjustment associated with mixture properties and density for each lot in accordance with the SS.

For all dense graded mixtures with pay item/DMF combination quantity **less than one lot**, the volumetric property/density portion of the QA Adjustment pay item is based on individual sublot QA test results. For all open graded mixtures, the volumetric test method is used regardless of lot or sublot size. The final Volumetric Acceptance results for each pay item/DMF combination includes composite pay factors for all mixture properties and density for each sublot. The PEMS uses this information to determine the pay factors and the QA Adjustment associated with mixture properties and density for each sublot in accordance with the SS.

The PEMS must verify that the final versions of the PWL or Volumetric results are used for determining the pay factors and the QA Adjustment associated with mixture properties and density. The Contractor has a right to dispute QA test results and until disputes are finalized, the QA test results and calculated pay factors are not final. If the final results indicate a QA test failure, the PEMS needs to verify that correspondence related to disposition of this failed material has been received. If no correspondence has been received, request a copy from DMT.

For contracts where the Inertial Profiler, HMA pay item has been included, use IRI for smoothness determination, the smoothness QA adjustment is determined by the IRI for individual sections of pavement. Refer to 401 and ITM 917 for the definition of an IRI smoothness section and the procedure for determining smoothness section limits.

After reviewing the IRI data, locate and mark all bumps and dips that exceed the smoothness limits in accordance with the SS. Sections of pavement evaluated for smoothness exhibiting an IRI that exceeds the limits indicated in the SS, may require corrective action to reduce the IRI to acceptable levels. After the Contractor has made corrections, additional runs with the profiler are required to verify all affected sections meet the smoothness requirements. The PEMS must verify that any repairs made by the Contractor do not expose underlying pavement courses. If underlying courses are exposed, repairs shall be made in accordance with the SS.

The PEMS should refer to 401 and use the IRI data to determine the smoothness pay factor for individual sections. The Department's Construction Information website provides IRI field guides and pay adjustment spreadsheets for use when analyzing IRI data from the ProVal application for QA adjustments.

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

After the total QA Adjustment for the contract has been determined, process a change order to facilitate the payment to the Contractor or the credit to the Department as appropriate. Attach all documentation used in calculating the QA Adjustment to the change order.

QA adjustments are calculated per DMF/per CLN/per YEAR. These should be made at the end of paving for each course or annually for multi-season contracts.

13.19 METHOD OF MEASUREMENT/BASIS OF PAYMENT

Because all HMA pay items are measured and paid for by the ton, collect weigh tickets from every truck that brings HMA material to the contract site. Determine if the entire load is placed on the contract. If a partial load is returned to the HMA plant, discuss the estimated tonnage returned with the contractor's foreman. Record the returned tonnage on the ticket. If agreement cannot be reached on the amount returned, request a "weigh back" ticket for the truck.

When E-ticketing is utilized on the contract, the PEMS should contact the AE or the appropriate CM Field Engineer to discuss the options and implementation of the process. Material delivery tickets may be either in paper or electronic ticket, E-ticket, format.

When E-ticketing is utilized, the Contractor is required to either use the Department's E-ticketing system or be approved by the Engineer to use an alternate E-ticketing system.

13.19.1 QC/QA-HMA Mixture Substitution

According to the SS, when original project plans call for a 19.0 mm HMA intermediate to be paved on top of a 25.0 mm HMA base course, the Contractor has the opportunity to pave both courses of pavement with 19.0 mm intermediate. The option is at the Contractor's discretion and at no additional cost to the Department. When this option is selected, it is an advantage for the Department. The reason for the advantage is that 19.0 mm is more desirable than 25.0 mm HMA because of the greater binder content, and the ease in achieving density. This option is also advantageous for the Contractor in the reduction of construction costs and allowance for thicker paving courses. Although, this does not exempt the Contractor from the limitations set forth in the SS for finished paving thickness, where 19.0 mm HMA can be paved up to 5 inches.

When this option is selected, a new 19.0 mm HMA pay item will be created by change order. The new computed unit price will be based on the original contract quantities and bid prices of the 19.0 mm and 25.0 mm HMA pay items. The new pay item will be the same course binder grade and category as the original 19.0 mm intermediate HMA pay item. The assigned quantity for the new pay item will be the summation of the original contract quantities of the 19.0 mm and 25.0 mm HMA pay items. Furthermore, the original 19.0 mm and 25.0 mm HMA pay item quantities will be subtracted on the change order to balance the new pay item.

An example calculation:
Using the original contract quantities from the example contract documents.

CLN	Item Description	Unit Price	Original Quantity Amount
0038	QC/QA-HMA, 4, 70, INTERMEDIATE, 19.0 mm	$94.20 TON	840.00000 $79,128.00
0039	QC/QA-HMA, 4, 64, BASE, 25.0 mm	$80.00 TON	2,056.00000 $164,480.00

New Unit Price = Sum of Contract Amounts / Sum of Contract Quantities

= ($79,128.00 + $164,480.00) / (840.00 ton + 2,056.00 ton)

= $243,608.00 / 2,896.00 ton

= $84.12/ton

A new pay item for "QC/QA, 4, 70, Intermediate, 19.0 mm" should be created by change order with a unit price of $84.12/ton for 2,896.00 tons.

13.20 WARRANTY HMA CONTRACTS (411 and 413)

The intent of warranty contracts is to establish performance criteria for the warranty pay items and require the Contractor to verify these criteria are met or exceeded throughout the warranty period. Therefore, no QA testing is required for any warranty pay items during construction.

The scope of inspection on warranty mixtures is as follows:

- Collect weigh tickets or utilize E-ticketing
- Check in-place yield of mixture.

On warranty contracts, the Contractor takes full responsibility for the performance of the constructed pavement during the warranty period. Therefore, Department personnel should not give direction to the Contractor which is contrary to the QCP. Requiring the Contractor to perform the paving operation in a manner contrary to their documented QCP intent may void the warranty objective.

There may be non-warranty pay items in warranty contracts. For these non-warranty pay items, normal SS requirements apply and normal sampling, testing, certification requirements, and inspection procedures are required.

13.21 DOCUMENTATION REQUIREMENTS

Keep the following documents in the contract file:

- Approved DMF
- QC Plan, Including Addenda
- QC Plan Approval or Rejection Correspondence
- PWL Acceptance Worksheets or Volumetric Acceptance Worksheets
- IRI Data Files
- Type D Certifications.

Hard copies of the above documents should be converted to digital format and stored in the project file or AWP as appropriate.

For 401 QC/QA mixtures, the PEMS should maintain a running total of the quantity of mixture associated with each pay item/DMF combination outside of AWP to determine the limits associated with individual lots and sublots. Document the limits of individual lots and sublots by entering the lane designation, beginning station, and ending station into the DWR on the applicable dates. When paving operations change lanes within a sublot, note the ending station in the first lane as well as the beginning station of the second lane into the DWR for the date that the lane change is made.

On a daily basis, calculate the total weight represented by the weigh tickets associated with each mixture pay item and record the weight into the DWR for the date that the mixture was placed.

Attach the calculator printer output to the weigh tickets for the day and maintain them in the contract file. If E-ticketing is used, maintain digital documentation of individual tickets and/or a summary log and store the documentation in the contract file.

If E-ticketing is used, maintain digital documentation of individual tickets and a summary log and store the documentation in the contract file.

For mixtures with QA pay factors calculated in accordance with 401.19(a), utilize the completed PWL Acceptance results obtained from the Department's HMA Pay Wizard application as documentation of pay factors associated with mixture properties and density by maintaining a digital copy in the contract files. Include copies of all calculations for determining the quality assurance adjustment for mixture properties and density. Include copies of any correspondence related to failed materials in the contract files as well.

For mixtures with QA pay factors that are calculated in accordance with 401.19(b), include digital copies of all Volumetric Acceptance results in the contract files as documentation of the pay factors associated with mixture properties and density. Include copies of all quality assurance adjustment calculations in the contract files. Include copies of any correspondence related to quality assurance adjustments for failed materials in the contract files as well.

For contracts with the Inertial Profiler, HMA pay item include all data files utilized for analysis of pavement section smoothness pay factors, the calculations of smoothness QA adjustments for individual sections, and the total smoothness QA adjustment for the contract within the contract files.

The contract files also need to include a digital tabulation of the overall contract QA Adjustment if both smoothness and mixture property/density components are required for the contract.

13.22 TACK COAT

Tack coat is used to prepare PCCP, milled, new, and existing asphalt surfaces for construction of an overlay or subsequent course of asphalt pavement.

13.22.1 Tack Coat Quality Control

Details regarding the tack coat operation are included in the QCP submitted by the Contractor prior to beginning paving operations. The PEMS must verify the Contractor follows all approved QCP content related to application of tack.

13.22.2 Tack Coat Materials

Tack coat materials include certain types of asphalt emulsions and PG binders. These materials are identified in 406.02 of the SS.

13.22.3 Tack Coat Equipment

Tack coat is applied to the pavement surface using an asphalt distributor meeting the requirements of 409.03(a) of the SS. Additional information regarding asphalt distributors can be found later in this document.

13.22.4 Surface Preparation for Tack Coat

The purpose for applying tack coat to a surface is to increase the bond between newly placed course mixture and the existing surface. Soil or other debris on the existing surface prevents this bond from occurring and defeats the purpose of applying the tack coat. All soil and other debris must be removed from the existing surface prior to applying tack.

A rotary power broom is commonly used for this purpose. If there are areas that require additional cleaning after the power broom operation, other measures must be taken to remove the objectionable material.

13.22.5 Tack Coat Application

The surfaces to be tacked need to be saturated surface dry to maximize bonding between the existing surface and the proposed course. A common area of contention between the Contractor and the Department is related to the degree of dryness necessary to place tack. It is acceptable to apply tack coat when there are isolated wet spots on the surface to be tacked. Isolated defined as the rough percentage of damp areas should be less than five percent.

There should be no standing water in any of these areas. If there is any question regarding whether the surface is too wet, notify the Contractor in writing that placement and performance of the tack coat as well as the paving operation is being performed at the Contractor's risk. Any delaminated areas shall be repaired by the Contractor at no additional cost to the Department.

It is important that the existing pavement be coated with the appropriate amount of tack in a uniform manner in accordance with the SS.

One common application problem is caused by clogged nozzles on the distributor spray bar. In situations where one or more of the spray bar nozzles are clogged, there will be portions of the existing pavement that are either lightly coated or not coated at all. If a distributor spray bar nozzle becomes clogged, the distributor should be stopped and the clogged nozzle or nozzles repaired or replaced prior to resumption of application of the asphalt tack emulsion.

Another problem which results in inadequate coverage of asphalt tack emulsion is improper distributor spray bar height. To achieve proper coverage, the individual nozzle spray streams must overlap sufficiently. If the spray bar is set too low to the surface, there will be insufficient overlap. If the spray bar is set too high, the overlap will not be uniform.

Figure 13.22-1 illustrates the proper double or triple overlap resulting from the asphalt tack emulsion being sprayed from the distributor spray bar.

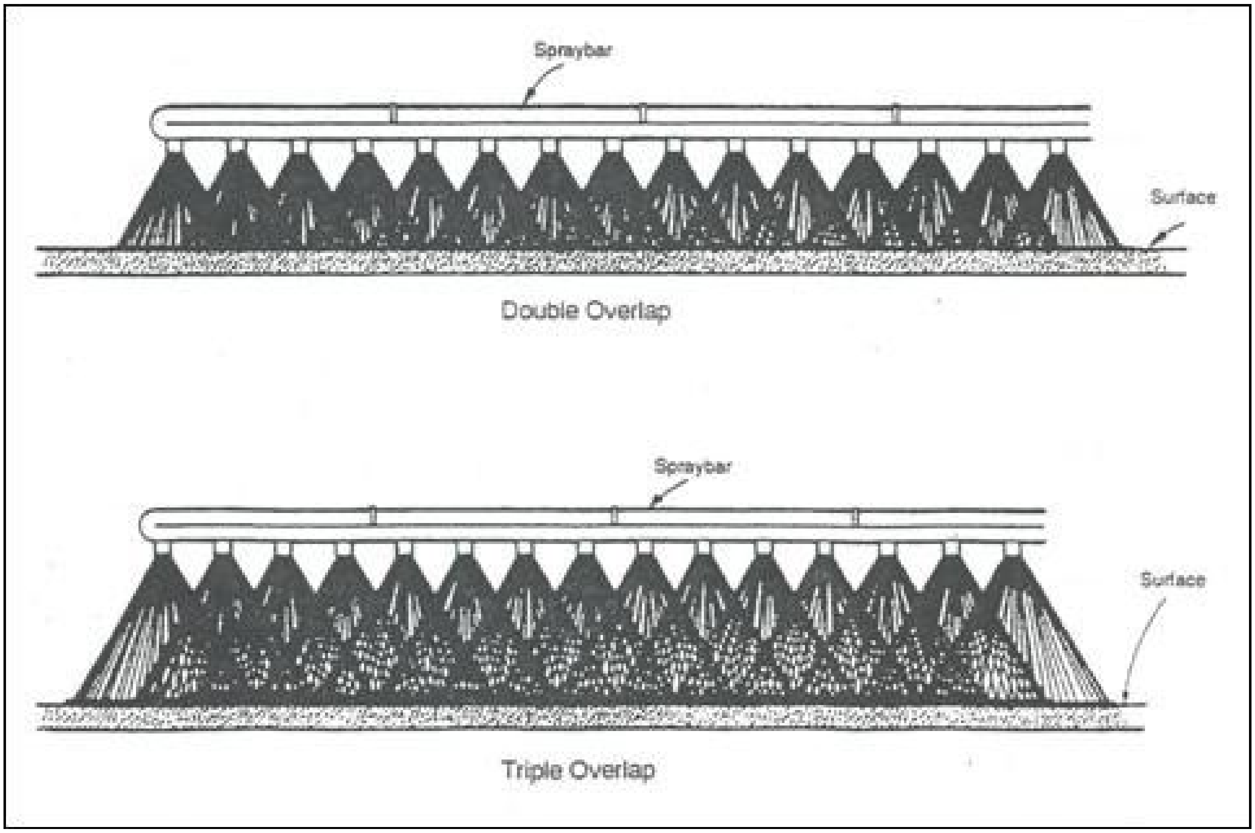


Figure 13.22-1. Desired Double or Triple Overlap

Figure 13.22-2 illustrates non-uniform coverage resulting from a spray bar installed at an improper height.

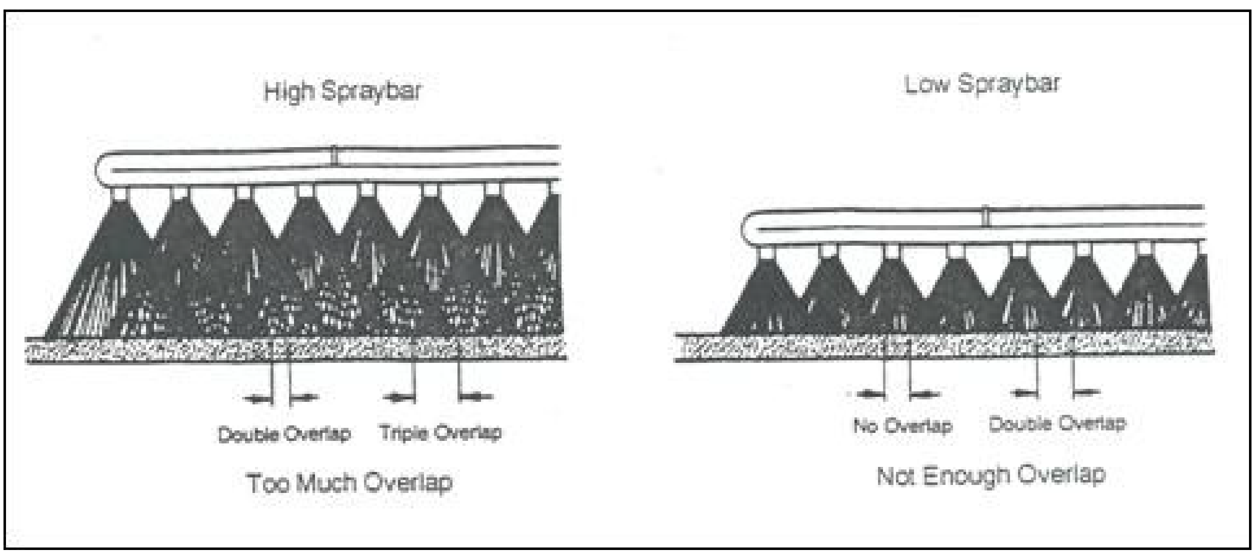


Figure 13.22-2. Non-Uniform Coverage Due to Improper Spray Bar Height

Distributor operation must be performed so tack is only applied to the intended surfaces. Wind or other environmental factors can result in uneven tack application. This problem can usually be solved by attaching a plate to the spray bar to contain the spray to the intended area.

Existing surfaces that cannot be tacked, because of inaccessible to the distributor, must be coated by using the distributor's hand spray wand or by hand application prior to construction of the overlying course.

When the tack coat is applied, it will be brown in color. After a period of time, the tack coat will turn black. At the time that this occurs, it is said that the tack coat has "broken". Once tack has broken, additional time may still be necessary for the tack coat to "set" to minimize tracking from equipment. The new asphalt course should not be placed onto the tacked surface until the break and set have occurred. The time required to achieve the tack coat break and set varies based on weather conditions such as temperature, humidity, and wind.

13.22.6 Tack Coat Documentation Requirements

Depending on the contract, tack coat is measured and paid for by either the ton or the square yard.

If tack coat is being paid for by area, determine the area covered by tack on a daily basis and enter the daily quantity in the DWR. Maintain a digital copy of the daily calculations and sketches in the contract file.

If tack coat is paid for by weight, collect the weigh tickets for each day. Calculate a daily total of weigh tickets to determine the daily quantity and record it in a DWR for each day that tack coat is placed. Retain the weigh tickets and calculator tapes as part of the contract file. Sometimes, a truck may need to be sent back to the weigh scales to obtain a weigh-back ticket. This ticket indicates the remaining weight of the truck and material after the day's application. The weigh-back ticket can be subtracted from the original ticket to obtain the material weight used for the application Another way to confirm tonnage used is to track the gallons placed. Many distributor trucks are equipped with a calibrated meter. A standard conversion is 240 gal/ton. It may be necessary to verify the meter's calibration and deduct and incidental quantity for daily maintenance.

If E-ticketing is used, maintain digital documentation of individual tickets and/or a summary log and store the documentation in the contract file.

13.23 SEAL COAT

The process of placing seal coat consists of one or more applications of asphalt material, each asphalt application is followed by an application of cover aggregate. This work may be referred to as "chip seal".

13.23.1 Seal Coat Quality Control
Quality control requirements for seal coat operations are found within 404.02 of the SS. The PEMS should review the Contractor's QCP as soon as possible after receipt. Seal coat operations cannot begin until QCP approval is provided to the Contractor. The PEMS should refer to ITM 803 for the Seal Coat QCP checklist. The intent of the QCP review is to verify all checklist items are included in the QCP. It is not intended to incorporate personal preferences of the reviewer into the QCP. However, prior to approval of the QCP, the PEMS should discuss all questions on checklist items with the Contractor.

13.23.2 Seal Coat Materials
The acceptable materials for seal coat asphalt and cover aggregate are listed in 404.03 and 404.04, respectively.

13.23.3 Seal Coat Types
The different types of seal coats are listed in 404.04. Types are identified by numbers from 1 to 7. In addition, a letter "P" may be added to the type, indicating that a polymer modified asphalt emulsion is required. Types 1 through 4 and 1P through 4P consist of one application of asphalt emulsion and one layer of cover aggregate. Types 5 through 7 and 5P through 7P consist of two applications of asphalt seal coat emulsion, with each emulsion application followed by an application of cover aggregate.

13.23.4 Seal Coat Weather Limitations
The weather limitations for seal coat application are listed in 404.05. Seal coats are required to be applied to dry pavements on warm days. The emulsions used in seal coats must "break" (as described in 13.22.5 above), in order for the seal coat to withstand traffic. Surface water or cool temperatures delay the emulsion "break" process and require traffic to remain off the treated pavement surface for longer periods of time. If it becomes necessary to perform seal coat operations outside the weather parameters of the SS, the PEMS should contact the AE for guidance.

13.23.5 Seal Coat Equipment
The following equipment is required for a seal coat operation:

- Rotary Power Broom
- Asphalt Distributor
- Aggregate Spreader
- Pneumatic Tire Roller.

A rotary power broom cleans the existing pavement surface prior to application of the asphalt seal coat emulsion and sweeps excess cover aggregate from a seal coated surface. An asphalt distributor applies the seal emulsion to the pavement surface. An aggregate spreader ("chip box" or "spreader box") spreads the cover aggregate onto the surface after the seal coat emulsion is applied. A pneumatic tire roller seats the cover aggregate into the seal coat emulsion. Steel wheeled rollers cannot be used in conjunction with seal coat operations. More information regarding equipment used in seal coat operations is included later in this document.

13.23.6 Surface Preparation for Seal Coat

Prior to applying the asphalt seal coat emulsion, the existing pavement surface must be clean. If the rotary power broom is not capable of removing all dirt or other material from the existing pavement surface, other measures must be taken to remove the objectionable material.

Prior to application of the seal coat emulsion, the PEMS should verify that all snowplowable pavement markers, structure castings, detector housings, and other items in the existing pavement requiring protection are covered. After completion of the seal coat operations, the PEMS must verify that the Contractor removes all protective coverings.

13.23.7 Seal Coat Asphalt Material Application

The surfaces that are to be seal coated need to be dry to maximize bonding between the existing surface, the asphalt seal coat emulsion, and the cover aggregate. A common area of contention between the Contractor and the Department is related to the degree of dryness necessary to place seal coat. It is acceptable to apply seal coat when there are isolated wet spots on the surface. Isolated defined as the rough percentage of damp areas should be less than five percent. There should be no standing water in any of these areas. If there is any doubt regarding whether the existing surface is too wet, notify the Contractor in writing that placement and performance of the seal coat operation is being performed at the Contractor's risk. Any de-lamination that occurs shall be repaired by the Contractor at no additional cost to the Department.

It is important that the existing pavement be coated with the appropriate and uniform amount of asphalt seal coat emulsion. One common deficiency is caused by clogged nozzles on the distributor spray bar. In situations where one or more of the spray bar nozzles are clogged, portions of the existing pavement will either be lightly coated or not coated at all. If a distributor spray bar nozzle becomes clogged, the distributor should be stopped and the clogged nozzles repaired or replace prior to resumption of application of the asphalt seal coat emulsion.

Another problem which results in inadequate coverage of asphalt seal coat emulsion is improper distributor spray bar height. To achieve the proper coverage, individual nozzle spray streams must overlap sufficiently. If the spray bar is set too low, there will be insufficient overlap. If the spray bar is set too high, the overlap will not be uniform. Refer to Figures 13.22-1 and 13.22-2 for proper double or triple overlap resulting from the asphalt seal coat emulsion being sprayed from the distributor spray bar.

13.23.8 Application of Seal Coat Cover Aggregate

Cover aggregate must be applied to the asphalt seal coat emulsion as soon as possible. When the asphalt seal coat emulsion is applied to the pavement, it will be brown in color. After a period of time, the emulsion will "break" or turn black. **After the seal coat emulsion has broken, it is too late to apply and seat the cover aggregate.** Since the breaking time depends on environmental factors such as temperature and wind, it is important that the cover aggregate be placed before the seal coat emulsion breaks.

13.23.9 Rolling of Seal Coat Cover Aggregate

The rolling operation seats the cover aggregate instead of compacting a mixture as in traditional asphalt paving. To seat the cover aggregate properly, the required roller passes must be performed prior to the break of the asphalt material.

13.23.10 Seal Coat Operation Traffic Control

To maintain safety for the traveling public during seal coat operations, the PEMS must verify that the Contractor has appropriate and sufficient quantity of signs and flaggers to direct traffic around an ongoing seal coat operation. The Contractor shall make accommodations for all emulsion tankers and aggregate hauling trucks to enter and leave the work area in a safe manner. In addition, once a seal coated lane is reopened to traffic, it is important to limit the speed of the traveling public so aggregate is not displaced by traffic prior to being embedded in the emulsion. This may require use of pilot vehicles to escort motorists through the contract area at a sufficiently slow speed.

Discuss traffic control with the Contractor at the Preconstruction Conference. The PEMS must verify that the Contractor is complying with the traffic control procedures included in the QCP during performance of the seal coat operation.

13.23.11 Excess Seal Coat Cover Aggregate Removal

The Contractor shall perform a brooming operation within approximately 24 hours after traffic has been placed on the newly seal coated surface. This prompt brooming operation will reduce the likelihood of damage to windshields and other vehicle parts due to excessive loose cover aggregate. A rotary power broom should be applied lightly to remove excess aggregate. The asphalt emulsion will not have fully cured therefore, the broom must be applied lightly and not dislodge aggregate that is coated, but not locked into the emulsion.

13.23.12 Seal Coat Documentations

Seal coat is measured and paid by the square yard. The PEMS must determine, on a daily basis, the area covered by the seal coat operation and note the quantity in the DWR. Include all daily calculations and sketches in the contract file.

13.24 ASPHALT PAVING EQUIPMENT

13.24.1 Asphalt Mixing Plant

HMA mixing plants are typically either batch plants or drum plants.

A batch plant produces HMA in batches. The maximum batch size is limited by the capacity of its pugmill. The pugmill is the chamber where the aggregate and the PG binder are mixed together.

Batch plants may be portable or stationary. Portable plants can be erected and utilized at a location for a certain period of time. They can then be disassembled and taken to a different location to repeat the process. Stationary plants are erected and operated at a fixed location for extended periods of time.

Typically, aggregates are stockpiled until the asphalt mixture production begins. The aggregates are then transported into the cold feed bins. It is then necessary to heat and dry the aggregates prior to screening and storing of the heated aggregates. It is also necessary for the PG binder to be stored and heated prior to beginning the mixing process.

The batch plant produces the asphalt mixture by combining the proper proportions of the aggregates and the PG binder. Finally, the resulting mixture is loaded into the hauling trucks and transported to the job site.

At a drum plant, the mixing of the aggregates and PG binder takes place in the same drum where the aggregates are heated and dried. Also, the aggregate gradation is controlled at the cold feed bins rather than undergoing a screening process as is the case at a batch plant.

13.24.2 Asphalt Distributor

Asphalt distributors are used to apply asphalt material associated with tack coats, prime coats, dust palliatives, and other types of liquid applications. Figure 13.24-1 shows an asphalt distributor in use.

Figure 13.24-1. Asphalt Distributor

13.24.3 Hauling Equipment

Typically, tri-axle trucks haul asphalt mixtures from the mixing plant to the job site.

The truck beds are required to be tight, clean, and smooth. Approved anti-adhesive agents are required to be utilized to prevent residual mixture from adhering to the truck bed. Also, the truck beds require waterproof covers to protect the mixture from adverse weather conditions, prevent contamination of the mixture, and to maintain temperature on cool weather days.

13.24.4 Material Transfer Device

Material transfer devices, sometimes referred to as shuttle buggies or MTDs, are sometimes utilized in a paving operation. An MTD effectively increases the size of a paver's hopper. This is beneficial because segregation can occur in a newly placed course when a paver is required to stop when it runs out of mixture. Figure 13.24-2 shows an MTD taking a tri-axle load of mixture into its hopper and simultaneously transferring mixture into the paver's hopper.

Figure 13.24-2. Material Transfer Device

13.24.5 Paver

The paver is the piece of equipment that receives the asphalt mixture from the haul truck or MTD and places it on the treated subgrade, existing pavement, or a previously placed course. Pavers must be self propelled and may be either equipped with wheels or tracks. Augers and vibratory screeds are used to distribute the mixture.

Most pavers also employ automatic grade and slope controls which enable the paver to place the asphalt course at the proper profile and cross slope. Other paver features include extendable screeds and extendable augers.

A typical paver is depicted in Figure 13.24-3a.

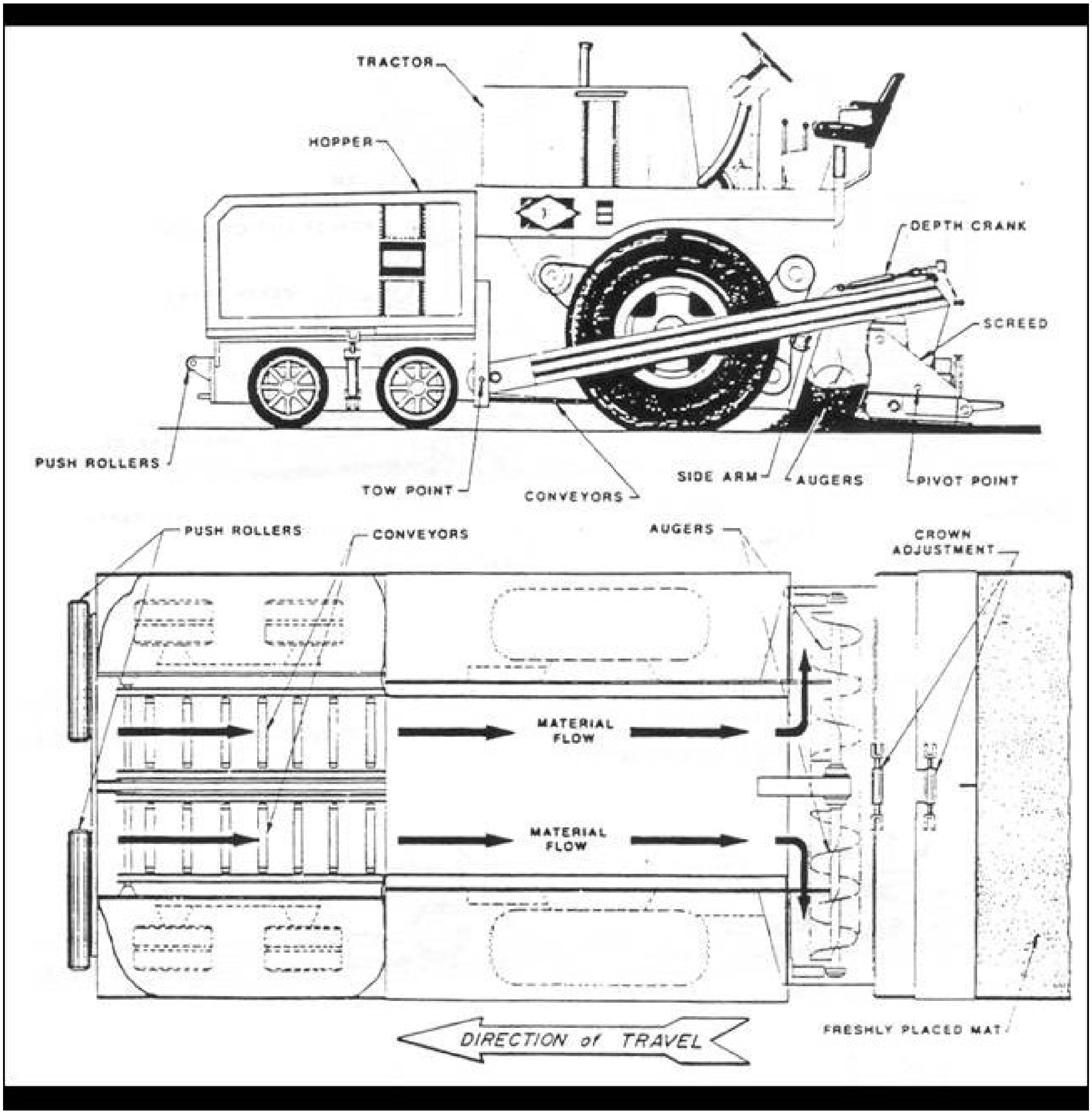


Figure 13.24-3a. Asphalt Paver

The use of spray pavers may be an option for the Contractor to consider for paving operations. Spray pavers combine the processes of both the paver and distributor truck into one machine. Spray pavers allow the Contractor to perform the application of an emulsion tack coat and the placement of an asphalt paving course in one process. The paver utilizes rows of emulsion distribution nozzles placed in front of the hopper and near the rear axle. The distribution nozzles can coordinate spray patterns to place a uniform coat of emulsion on the existing surface.

The distribution nozzles provide a consistent and uniform application just prior to the placement of the asphalt pavement course. This process helps eliminate the potential for the traveling public or the paver to track emulsion on tires or treads.

These pavers can also perform paving operations without utilizing their emulsion application process. Spray pavers must be in accordance with 409.

A typical spray paver is shown in Figure 13.24-3b.

Spray paver nozzle distribution of emulsion is depicted in Figures 13.24-3c and 3d.

Figure 13.24-3b. Typical Spray Paver

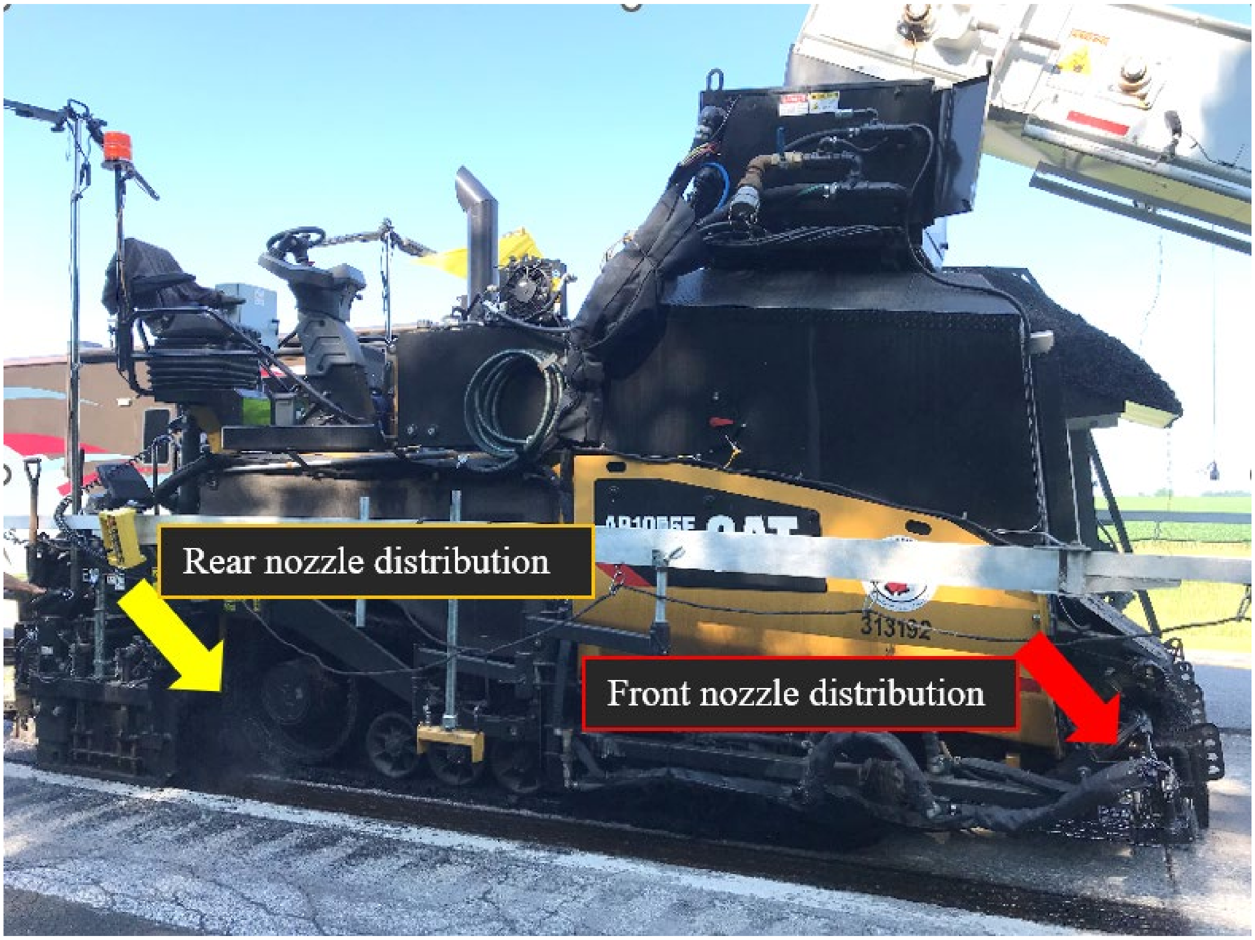


Figure 13.24-3c. Spray Paver With Front and Rear Nozzles Identified

Figure 13.24-3d. Spray Paver Emulsion Application Locations
Red indicates front nozzle application, and
Yellow indicates rear nozzle application

13.24.6 Wideners

Wideners are used in situations where the required paving width is insufficient to accommodate a paver. This piece of equipment typically casts the mixture to the side and is usually used to widen an existing pavement. Wideners are equipped with an adjustable screed which is capable of constructing a course to the proper grade and slope.

Figure 13.24-4 depicts a typical widener in use.

Figure 13.24-4. Widener

13.24.7 Tandem Roller

Tandem rollers have two axles/rollers. A tandem roller is used to compact newly constructed courses. The minimum weight for a tandem roller is 10 tons.

Figure 13.24-5 illustrates a tandem roller in use.

Figure 13.24-5. Tandem Roller

13.24.8 Three-Wheel Roller

Three-wheel rollers have three rollers, one on the forward axle and two on the rear axle. There is a minimum bearing requirement for the rear wheels of 300 lb/in in accordance with 409.03(d).

Figure 13.24-6 shows a three wheeled roller in use.

Figure 13.24-6. Three Wheeled Roller

13.24.9 Pneumatic Tire Roller

Pneumatic tire rollers may be used to compact QC/QA HMA or HMA mixtures but are not frequently used for that purpose. They may also aid in achieving density requirements in situations where steel-drum rollers may not suffice due to underlying pavement conditions. Pneumatic tire rollers are required to be used to seat the cover aggregate into the asphalt material in seal coats.

Requirements related to pneumatic tire rollers are included in 409.03.

Figure 13.24-7 shows a pneumatic tire roller in use.

Figure 13.24-7. Pneumatic Tire Roller

Figure 13.24-8 illustrates how the tires on a pneumatic tire roller are offset to facilitate complete coverage of an asphalt mixture or complete seating of seal coat cover aggregate with each pass.

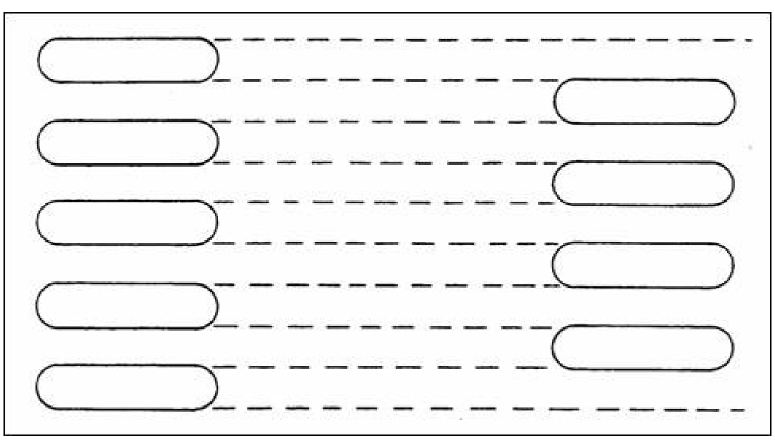


Figure 13.24-8. Pneumatic Tire Roller Tire Offset

13.24.10 Vibratory Roller

The rollers discussed previously use only the weight of the roller to achieve compaction while operating in static mode. Vibratory rollers are capable of imparting an impact loading on the mixture as they vibrate during operation. It is possible to control the frequency and the amplitude of the vibratory effort imparted by the roller.

Figure 13.24-9 shows a vibratory roller in use.

Figure 13.24-9. Vibratory Roller

13.24.11 Trench Roller

Trench rollers can be utilized to compact asphalt mixtures in situations where the width of course to be rolled is too narrow for traditional type rollers.

Figure 13.24-10 shows a trench roller.

Figure 13.24-10. Trench Roller

13.24.12 Aggregate Spreaders

Aggregate spreaders are sometimes referred to as chip boxes or spreader boxes. They are used to distribute cover aggregate over a freshly applied asphalt emulsion in seal coat operations.

Figure 13.24-11 shows an aggregate spreader in use.

Figure 13.24-11. Aggregate Spreader

13.24.13 Rotary Power Broom

Rotary power brooms can be used in multiple applications related to paving operations. They are used to clean existing pavements or previously placed underlying mixtures prior to placing tack coat. They can also be used to clean existing pavements prior to applying asphalt emulsion for seal coat. A third use for power brooms can be to remove excess cover aggregate from a newly placed seal coat.

A rotary power broom is shown below in Figure 13.24-12.

Figure 13.24-12. Rotary Power Broom

13.25 PG ASPHALT BINDER MATERIAL COST ADJUSTMENT

13.25.1 Introduction

Payment adjustments based on the change in cost of PG asphalt binder material is discussed in 109.05.3 of the SS. The cost of virgin PG binder material is tracked as an index on a monthly basis and the SS allows for a payment adjustment if the index for a given month varies more than 10% compared to the index in effect at the time of letting.

At the time a bid proposal is submitted, the Contractor will elect whether or not to enact the PG binder adjustment. This election will be noted on the proposal page of the bidder's submittal.

If the Contractor has opted out of using the PG binder adjustment, the specification and the pay item are not used on the contract. The Contractor cannot decide to utilize the option after submitting their bid.

If the Contractor has opted to include the specification, any HMA pay item with an original or revised quantity greater than or equal to 2,000 tons will require pay adjustments for the PG binder used in all HMA mixture pay items on the contract. It is important to note that the specification does not become effective until at least one HMA item's revised quantity meets or exceeds the minimum requirements and that only future quantities are eligible for payment adjustments.

Payment adjustments will only be applied to contract pay items for HMA mixtures paid in accordance with 304, 401, 402, 410, 414, 610 and 718.

13.25.2 Calculation of Adjustments

When a Contractor has opted to use the PG binder adjustment specification and the contract meets the quantity requirements, it will be necessary to perform a monthly analysis, in accordance with the SS, to determine whether additional payment is due to either the Contractor or the Department based on fluctuations in the actual PG binder material cost.

PG binder price fluctuations are measured by the ratio of a binder index (BI) to an established letting binder index (LI) for the contract. The BI is determined by M&T and is published on a monthly basis on the Department's website. The letting index (LI) is the BI for the month prior to the contract letting date and will serve as the baseline of comparison for the BI throughout the duration of the contract.

If the BI for a given month is within 10.1% of the LI, no monthly adjustment is required. If the BI is at least 10.1% greater than the LI, then the Contractor is due additional payment for all HMA pay items under consideration in the contract placed during the month. If the BI is at least 10.1% less than the LI, then the Department is due a credit for all HMA pay items under consideration on the contract.

A spreadsheet is maintained on the Department's website and is available to calculate the required monthly payment adjustments as necessary.

After the end of a given month, it will be necessary to determine the quantities associated with each HMA mixture pay item/DMF combination during that month. This information, along with the BI associated with the month of placement, is input into the spreadsheet to determine whether or not a payment adjustment is required. Any monetary adjustment should be incorporated into a progress payment estimate within 30 days of the end of the month being analyzed.

13.25.3 Spreadsheet Data Input Instructions

Locate the spreadsheet on the Department's website and save a copy. Enter the required data for the month and save a copy of the completed spreadsheet as part of the contract files. This process will be repeated for each month throughout the duration of the contract.

The data fields that require user input are highlighted on the spreadsheet. The other boxes in the spreadsheet are locked and are used to display information or results which are calculated automatically.

1. **Contract No.** – Enter the contract number in the format "Prefix-XXXXX".

2. **Letting Date** – Enter the date of the letting in the format MM/DD/YYYY.

3. **Month & Year of Calculation** – Enter the month and year that the adjustment is being calculated for in the format MM/YYYY.

4. **LI** – Enter the binder index for the month before the letting. This information is available from M&T and on the Department's website. The LI is the BI for the month prior to the month of the contract letting. Once the LI value is determined, it will remain the same throughout the contract duration.

5. **BI** – Enter the binder index for the month under consideration for the adjustment determination. This information is available from M&T and on the Department's website.

6. After the **LI** and **BI** are entered, two calculations will be performed:

   a. The **(BI – LI)/100** will be calculated to the nearest 0.001.

   b. The absolute value of **(BI – LI)/100** will be compared to 0.101. If the result is less than 0.101, then no adjustment will be made for the month and the result of $0.00 will be shown in **Payment Adjustment, PG Asphalt Binder.** If the result is equal to or greater than 0.101, then a payment adjustment will be calculated for each pay item on the spreadsheet and the total adjustment for the month will be shown in **Payment Adjustment, PG Asphalt Binder.**

7. **MPA Data** – Enter the information in the highlighted boxes for each qualifying HMA pay item. The data in this section must be broken down by pay item and DMF. If a Contractor uses multiple DMFs for a single pay item, there needs to be separate entries for each pay item/DMF combination. For example, if a Contractor places HMA Base, HMA Intermediate, and HMA Surface during a month under consideration, which is paid in an "HMA for Approaches" pay item, there would be at least three entries for that pay item because each mixture requires a different DMF.

   Once the user has determined all the applicable pay item/DMF combinations, the appropriate data for each combination is entered. This data includes **"HMA Pay Item No."**, **"Pay Item Description"**, **"Q"** (quantity of mixture placed for the month by DMF), **"DMF"**, and **"P_b"** (percentage of virgin PG binder used in the mixture from the DMF). Once this data is input, the spreadsheet automatically calculates the payment adjustment dollar amount for each line and also calculates the total adjustment for all mixtures for the month.

   The quantity of HMA placed, Q, is defined in the SS as "Quantity of a HMA pay item placed, in tons, entered to the actual 0.01 unit placed. The quantity will be calculated prior to any calculation of any other quantity adjustment". The value of Q is the actual tonnage prior to being adjusted by the MAF.

8. **Item No.** – Below the "MPA Data" table, input the contract pay item number for Payment Adjustment, PG Asphalt Binder from the Schedule of Pay Items.

9. **FCR Page No.** – The spreadsheet is set up to allow the user to print a hard copy of each month's adjustment. The user should input the appropriate page number for the month in sequence throughout the duration of the contract. The spreadsheet has no provision to automatically number the pages, so the data must be input.

An example spreadsheet showing entered data and results is also available on the Department's website. The user can change the LI, BI and Q to see how changes affect the adjustment calculation.

13.25.4 Spreadsheet Data File Management

It is recommended that the spreadsheet for each month be saved using a unique filename as follows (consistent with the Intelligent File Cabinet's document naming convention):

PGBA_123_Binder Index_"Optional Description"_YYMMDD

Where:

PGBA =	Alphanumeric document identification for **PG** **B**inder **A**djustment
123 =	Last three digits of the project's DES number
Binder Index =	First description of the document
"Optional Description" =	Optional secondary description of the document
YYMMDD =	Date of document with 2 digits for year, month, and day.

The spreadsheet should then be attached to the Materials file within the contract's Intelligent File Cabinet.

Questions about the PG Binder Index and spreadsheet should be directed to the Construction Field Engineer for the District.

Section 14:

Utility Relocation Inspection Procedures

SECTION 14 – UTILITY RELOCATION INSPECTION PROCEDURES

14.1 INTRODUCTION

On most highway improvement contracts there will be utility facilities located within or adjacent to the contract limits. Some of the facilities may be in conflict with the proposed construction, some may be in the process of relocating out of conflict, and some facilities may not be in conflict with the proposed construction. FHWA requires the Department to minimize or avoid impacts to utility facilities whenever feasible. The constructability reviews during project development are critical to successful progress on construction contracts. These reviews are the most opportune time for developing the correct utility work plans and subsequent contract bid documents. The AE should consider these reviews as a primary responsibility of the assigned PEMS. Contractors are required to coordinate work schedules with the utilities indicated in the CIB, work around existing utilities as shown on the plans, and prepare areas for utility relocations as presented in the CIB. The PEMS will bring critical field experience and input into the development of utility work plans and design plans.

The Department manages contract utility facilities by coordinating with identified utilities prior to construction and developing utility relocation work plans. These work plans coordinate the location, schedule, and work of the Utility with the contract. A Work Plan Approved letter is issued for all relocation work plans that are acceptable to the Department. A permit number is issued with this letter. In this letter, the Utility is provided a notice to proceed with their pre-construction activities. A Notice to Proceed with Construction letter will be issued by the Utility Coordinator once work required by the Department or the Contractor is completed. Utility work plans are reflected in the CIB and the locations are in the utility relocation drawings uploaded to the bid documents for the Contractor to review. The goal of the Utility and Railroad Section is to address all utility related concerns and keep the contract team informed. The concept is to deliver information in sufficient detail, so the contract team has no surprises regarding utility coordination. The Utility Coordinator is the point person for all utility related concerns from contract inception to conclusion.

14.2 AUTHORIZATION

Authorization for a Utility to start pre-construction activities is provided in the Work Plan Approved letter. Authorization for a Utility to start construction activities is provided in the Notice to Proceed with Construction letter. These letters are issued by the Utility Coordinator.

The PEMS will verify that a Utility planning to work or actually performing work within the right of way has a Notice to Proceed with Construction letter issued by the Utility Coordinator. Also, the PEMS will verify Utility work is appropriate with the contract documents and coordinated with the work of the Contractor to help progress the contract in accordance with the identified schedule.

14.3 PRE-CONSTRUCTION CONFERENCE

When utilities are involved in a contract, a portion of the pre-construction conference should be devoted to discussing and coordinating work schedules with the Contractor and subcontractors. The work schedule discussed in the pre-construction conference should also coordinate with the contract utility provisions. The contract utility provisions are drafted by the Utility Coordinator in coordination with each impacted Utility. The provisions are derived from Utility Work Plans negotiated with the Utility and are intended to comply with the contract. Any post-work plan changes or new expectations of a Utility must be coordinated through the Utility Coordinator and may result in additional costs to the Department or the Contractor. The PEMS should prepare minutes of the utility discussions and include them in the pre-construction conference minutes. The proposed scheduled starting dates, anticipated completion dates and any applicable or intermediate dates, should be noted. On contracts where there are major utility concerns, additional utility meetings may be appropriate and become part of the regularly scheduled progress meetings. Utilities in attendance should be organized by 1) the complexity of the Utility relocation required, and 2) the availability of the Utility Coordinator coordinating all utility schedules with the construction progress schedule.

As part of the utility portion of the pre-construction conference, the PEMS should request a list of contact names from each utility involved in the contract from the Utility Coordinator. Although the contract may include some contact information, it should be verified and updated in the utility discussions. The Utility Coordinator is the primary contact for all utility related concerns. This will help free the PEMS to manage the contract. The PEMS will have this contact information for the Contractor's required notification to utilities.

Special emphasis must be given to the review of the existing and proposed locations of aerial lines. The Contractor must consider utility relocation work in their work plan and bidding of the contract. Possible conflicts with the Contractor's construction equipment (cranes, backhoes, pile driving equipment, etc.) may not have been known at the time of the Utility's plan formulation or the Department's review of the plans. The utility relocation drawings in the contract documents should be considered in the Contractor's bid and are not a basis for requiring changes in a Utility's permitted locations. If the Contractor chooses a means or method of construction that requires a change in a Utility's permitted location, the PEMS must inform the Contractor that they shall have to negotiate the additional cost with the Utility and seek a permit addendum from the Utility Coordinator.

The following should be documented in the AWP Diary:

- the date the area necessary for each Utility to relocate was staked,
- the date any obstruction was cleared for the Utility,
- the date each Utility was contacted regarding starting their work,
- the date the Utility actually started work, and
- any adverse conditions causing delay in the sequence of operations.

The PEMS should note specific items of assistance that were provided to the Utility such as locating the centerline of the road, establishing grade stakes in advance of normal staking, etc. Unless covered at a recent pre-construction conference, a comprehensive review of the work to be performed should be made at the start of the Utility relocation work.

14.4 INSPECTION

The degree of inspection of utility construction will vary considerably depending on the type of contract and the nature and location of the Utility work involved. Judgment must be exercised regarding the manner and regularity of inspection. It may vary from spot checks on minor overhead installations to more detailed inspections of underground facilities.

The following items should be noted:

a. Be observant of proposed grade and alignment of utility relocations and check that the Utility plans are compatible with the road structures and construction features.

b. Verify that proper backfill methods and materials are used where proposed and future road surfaces and berms are planned.

c. Be observant for any substantial change in the Utility's methods and materials from those approved, such as the use of sheeting, special backfill, etc. The PEMS should immediately contact the Utility Coordinator to discuss these changes with the Utility. For reimbursable utilities, there can be no payment for any work in addition to the approved work. Therefore, such approval must be obtained before starting any procedural changes.

d. Be sure that the Utility foreman is familiar with symbols furnished on the construction stakes, such as cut and fill information, and that both the Utility and Contractor use the same information.

e. Spot checks should be made to verify that trench depths are compatible with highway surface plans, that the vertical clearance of overhead utility installations are sufficient to ensure minimum clearance above highway structures, and that horizontal alignment is compatible with construction limits, access lines, etc.

Utilities are authorized, after obtaining the Notice to Proceed with Construction letter, to perform all necessary work involving minor changes in quantities or additions of minor items deemed necessary to accomplish the intent of the approved agreements. However, no reimbursement can be made without prior approval. Contact the Utility Coordinator for issuance of that approval.

Approval must be secured from the Utilities and Railroad Section for substantial changes in the scope of work. Examples of possible substantial changes are changing a planned aerial road crossing to a buried crossing, changing the method of installation from open trenching to a directional bore, and any proposed change to a permitted location. In non-emergency situations, the proposal for such a change must be submitted in writing by the Utility to the Utility Coordinator. As much detailed information, sketches, estimates (if work is being performed by contract, the Engineer's estimate should be made prior to Contractor's proposal), costs, and as much other documentation as practical must be provided by the Utility.

The Utility Section will inform the Utility of approval of design changes. If timing is critical, the necessary communication can be accomplished by phone or e-mail and confirmed in writing as soon as practical.

It may be difficult to define or otherwise describe the limits of "substantial change" due to variations in cost of work, its complexity, the variable situations, and terrain encountered. It is undesirable to request approval for every recognizable change. In case of doubt, and where the change will increase the utility agreement cost, the Utility should request approval for the change from the Utility and Railroad Section.

14.5 RECORDS

Utility relocation work records should be kept in sufficient detail by the PEMS to identify conformance with the relocation plans and schedule. These records can become very important when analyzing a claim for utility delay by the Contractor or a claim for additional compensation by a Utility. In general, more detailed records should be kept for utility work that is reimbursable as opposed to non-reimbursable work. The different methods of payment for a Utility's relocation work determine the type of records to be kept at the contract level. These are described below:

a. For reimbursable work performed entirely by the Utility with Utility forces only, the records should include the number and class of employee, major equipment on site, principal materials used, and materials removed from the site. Pertinent data such as weather conditions, ground conditions, breakdown of equipment, delays due to conflicts with other Utility forces or Contractor's operations, should be noted. Any conversations with the Utility, District, or the Utility and Railroad Section should be noted.

b. For reimbursable work in which part or all the work is being performed by a Contractor having a continuing contract with the Utility, the same records are required as in (a) above unless the agreement clearly establishes the work being performed under a continuing contract is on a unit of work basis, rather than a manpower and equipment basis. If it is clearly on a unit of work basis, only the units of work completed per day by the Contractor need be recorded. Work performed by the Utility's own forces in conjunction with a continuing contract should follow (a) above.

c. For reimbursable work being performed in part or completely by outside Contractors on a unit of work basis, records should cover the units of work performed on a daily basis. On contracts being performed in part or completely by an outside Contractor on a firm bid basis, items of labor and equipment used by the Contractor can be deleted from the record. In those instances when extra work is performed by the Contractor on a per hour or per diem basis, items of labor and equipment must be maintained for the record. The units of work completed should be recorded daily for checking payment to the Utility for their Contractor's work. This should include such items as the number of poles installed, the amount of wire strung, the lineal footage of pipe or casing installed, the length of line removed, and the amount of trenching, or any other work unit.

d. On lump sum agreements between the Department and the Utility where work is being performed by either utility forces, under a continuing contract, or a Contractor selected by competitive bid, the daily checks on manpower, equipment, and material can be omitted.–Detailed reviews should be made during installation and at the final utility inspection to ensure conformance with the agreement. In these instances, the Utility will be paid the exact amount of the original or modified agreement regardless of the actual cost incurred by the Utility, if they have satisfactorily performed all work covered by the approved plan. When a Utility uses inspection personnel to inspect the work being performed, records should be kept identifying the hours and rate for the Utility's inspection personnel. Particular emphasis should be given to inspection personnel not on the Utility's payroll. Such outside inspection services will usually be covered by a contract between the Utility and the inspection firm. A copy of the agreement should be requested to determine compliance with the agreement.

14.6 SALVAGE MATERIAL

Salvage of materials is the reclamation of materials from a contract site that have some continued value. Salvage value is the monetary value of these reclaimed materials either through reusing the materials or recycling the materials. There are three types of salvage involving utility materials:

1. For reimbursable work, the Utility must reclaim all materials for which the salvage value exceeds the cost of removal unless otherwise coordinated with the Department. The salvage value is a credit to the Department on the cost estimate of the agreement. The Utility shall include the actual salvage value as a credit to the invoiced cost of the agreement.

2. For non-reimbursable work, the salvage value is a credit to the Utility owning and reclaiming the materials.

3. For Utility materials retired and left in place on the contract site, the responsibility remains with the Utility until the materials are removed by either the Department or the Contractor. The Contractor must reclaim all materials for which the salvage value exceeds the cost of removal. All materials required to be removed by the contract must be

salvaged. The Contractor must provide a credit to the contract for all salvaged materials. The salvage value is a credit to the Department on the cost of the contract. The PEMS must track the status of these salvageable materials.

The Utility Coordinator will work with each Utility to determine if any materials will be "retired in place". This will be reflected in the Utility's work plan and in the estimates. The Department has eliminated the use of "abandoned" materials. The Utility will remain accountable for the costs of addressing asbestos materials and any environmental concerns that arise out of leaving materials on Department right-of-way. If a Utility chooses to retire a facility in place, it is understood that the Department can perform any construction activity necessary to complete the contract without regard to the impact on the Utility's retired in place facility, including removal for disposal, salvage, or reuse.

These determinations will be made during contract development in constructability reviews then placed in the Utility's work plan and in the contract bid documents as appropriate. However, if additional issues arise during the contract, the Utility Coordinator will work with the PEMS and the Utility to help bring resolution to the issues. The Department will determine whether it is desirable to recover materials that do not require removal because of construction requirements. Therefore, the Engineer must review the agreement with the Utility representative to determine whether the facility was proposed and approved to be removed.

If an agreement called for removal, a determination shall be made that removal is still necessary due to the construction. If the material is not required to be removed because of construction, then determine the economical and liability justification for removing such facilities.

The utility agreement will normally reflect if the material is to be salvaged by the utility, the expected salvage credit will exceed the removal, transporting, refurbishing, and return costs. Otherwise, the agreement will call for in place retirement unless it was presumed that retirement of the material would create a potential liability to the Department, to the Utility, or if it would be detrimental to the present contract or future use and safety of the road. If the facility is removed due to a field decision and the Utility desires the materials for future use, determine if the credit given the Department for the material will exceed the cost of recovery, transporting, refurbishing, and return costs. If the credit proposed by the Utility does not exceed these costs, the material shall be disposed of. This should be discussed with District Utilities.

If the agreement calls for removal and salvage of items that could be retired in place, but unusual field conditions are encountered at the time of removal operations, a discussion with the Utility representative concerning the salvage credit should be conducted. The discussion should concentrate on whether the credit will equal or exceed the cost of removal and salvage under these changed conditions. If the Utility cannot confirm the salvage credit, the cost of salvage, and the cost of removal, the PEMS should classify this as a substantial change in scope of work and act accordingly.

When the agreement calls for retirement of specific parts or all the facility, but such retirement will, in the opinion of the Engineer, constitute a hazard or liability to the Department, to the Contractor, or adversely affect the work of the Contractor, it shall be treated as a substantial change. Approval to remove the facility will be requested through the Utility and Railroad Section. After approval, the Utility should be instructed to remove the facility and the contract record should note the reason for the change.

It is the opinion of the Utility and Railroad Section and FHWA that, in general, all pipe 12 in. or less in diameter can be retired in place. The final determination to abandon is the responsibility of the DO and the Utility concerned.

14.7 FINAL INSPECTION OF UTILITY

The final inspection of utilities varies based on whether the relocation work was performed by the Utility or by the Contractor as part of the contract. There is little difference between reimbursable and non-reimbursable utility inspections.

For relocation work performed by the Utility, the PEMS has no specific duties to verify accurate placement. However, the PEMS is required to verify the Contractor and Utility personnel are coordinating the execution of the work as necessary to maintain the contract schedule.

For relocation work performed by the Contractor, the PEMS has the same requirements for supervision, inspection, and record keeping for the work as any other work in the contract.

At the conclusion of the utility work, a final inspection should be conducted in the presence of the Utility representative, the Contractor, and the Utility Coordinator to determine conformity with the approved original or modified utility work plan. The Utility Coordinator should be consulted on additional attendees for this final inspection. A report should be written to the contract file, with a copy going to the DO, which states the date the final inspection occurred, who was in attendance, and the outcome of the final inspection. The Utilities Coordinator will issue a letter of “Acknowledgement of Completion” to each approved Utility. A copy of the letter should be maintained in the contract file.

In the event that a change to the Utility’s work plans becomes necessary, the change may be authorized in the field upon the PEMS approval. They should consult with the Utilities Coordinator and must keep written documentation of the changes approved. The Utility and Railroad Section will assist as needed with any determination on changes. The primary concerns are that Utilities do not interfere with the construction or safety at the contract and that relocation follows the Department’s Utility Accommodation Policy for the permitted location. It is preferred that all changes to the Utility’s work plan are approved by the Utility Coordinator.

14.8 TRANSMITTING RECORDS

The PEMS must partner with the Utility Coordinator to create and maintain adequate records. These records will be copied to the Utility Coordinator for use in reimbursement of the Utility’s work and in final audit.

14.9 ASSISTANCE TO THE UTILITY

The Utility may require assistance in completing their relocation, such as staking of right-of-way, interpreting plans, etc. While it is up to the Utility to do their relocation, it may be in the best interests of the Department for the Contractor to provide the Utility with appropriate assistance so the Utility relocates their facilities in the proper location. If the PEMS or the HT observes a Utility placing their facilities in a location that will cause conflict, the Utility must be advised of the problem immediately.

Section 15:

Finishing Shoulders, Ditches, and Slopes

SECTION 15 – FINISHING SHOULDERS, DITCHES, AND SLOPES

15.1 FINISHING SHOULDERS, DITCHES, AND SLOPES

The final shaping and dressing of shoulders, ditches and slopes is not a pay item but is included in the cost of other bid items on the contract.

This work consists of the final shaping and dressing of shoulders, ditches and slopes by machine, by hand methods, or both, to the required smoothness, elevation, and cross section shown on the plans or as directed by the Engineer.

Shoulder construction should be in accordance with the typical sections and Standard Drawings included as a part of the contract plans. Check the typical sections and Standard Drawings for the details on shoulder slope in tangent sections and changes in shoulder slope within super-elevated curves.

The scope of shoulder construction on HMA resurfacing contracts is covered in Section 208 of the SS. In many instances the resurfacing contract specifies increasing the super elevation in the old pavement to comply with current design standards. When this situation is applicable, the additional fill dirt for shoulders on the high side of the curve may be obtained from suitable waste or excess trench widening excavation elsewhere on the contract. They may also be constructed with borrow, if specified in the contract. The use of borrow for this purpose is discussed in Section 3 of these instructions.

Due to the limited width of the available roadbed, it may not be possible to construct the high shoulder in strict accordance with the plans. Modifications will then be necessary. These modifications should be discussed with the AE unless the contract is specific with respect to the cross section at these locations. All ditches must be constructed so that they will drain and be free of water pockets. At the ends of cuts, flare the side ditches out away from the centerline to prevent ditch water from being spilled onto the fill embankment. Abrupt changes in alignment of side ditches should be avoided and any contemplated changes in ditch alignment or grade should be provided during grading operations to avoid the potential for major revision of slopes and ditches during the finishing operations.

Slopes shall be uniform. Transitions from steep slopes to flat areas shall be constructed so no abrupt changes or bulges result. To obtain a more pleasing appearance, roll back the ends of cut slopes slightly. In finishing the slopes of rock cuts, the rock face must be carefully inspected for loose or overhanging rock that might subsequently fall onto the roadway. All such rock shall be removed.

The amount of work necessary to finish the shoulders, ditches, and slopes on a contract can be materially reduced if the Contractor completes grading operations for the cross sections as work proceeds. It is neither economical nor good construction practice to incorporate fill yardage that should have been moved during the early grading operations into the finishing operations. If the Contractor’s methods result in rough or otherwise unsatisfactory shoulders, ditches, or slopes, they shall be corrected before being accepted.

If surplus soil is generated during finishing operations and it is decided to use the surplus material to widen the existing shoulders, care must be taken to verify loose material being dumped along the side of the embankment does not result in sloughing. Section 203 of the SS should be referenced for guidance when using excess material to widen existing slopes.

Section 16:

Approaches

SECTION 16 – APPROACHES

16.1 POLICY AND PERMITS

There are several types of drives, designated by class, within the Standard Drawings. Drives to be constructed as a part of a contract will be shown in the Approach Table of the plans. In that table, the approaches are described by location and class as well as the length and width of the drive, the radii, estimated quantities of earthwork, and surfacing material. In general, commercial drives, private drives, and field entrances will be replaced in kind.

It is the policy of the Department to replace existing commercial and private approaches and field entrances. Occasionally private approaches are constructed after completion of the original survey, but prior to award of a contract. Should there be approaches requiring replacement but not provided for on the plans, the PEMS should determine, to the best of their ability, when such approaches were constructed and contact the PM and AE.

If the Right-of-Way Grant specified an additional approach, the additional permanent ROW required does not change any related permits. Quantities for the construction of the approach that have not been included in the contract will require a Change Order to be prepared. If the additional ROW was not accounted for, the AE and PM should be contacted. If they determine permanent ROW is required, then work on that approach cannot begin until the environmental document and the CSGP are amended and the additional ROW is acquired. If temporary ROW is needed, work on the approach cannot begin until a right-of-entry is secured. The AE and PM should be contacted.

New drives or any relocation of drives within limited access ROW or interstates must be authorized by FHWA. Other added or relocated drives on Department ROW must be authorized by the District Permits section. When an authorized relocation of a planned drive occurs or when a new drive is authorized and added to an active construction contract, and these changes have been documented by a change order the “as built” plans will serve as the official record of these drives. This procedure will provide accurate records of additions or changes to drives constructed on the contract.

Any drives, other than those provided for in the contract plans or documented by change orders, shall be authorized by FHWA or the Department, depending on the type of contract, and constructed at the property owner’s expense, after first having obtained an approved permit. In the event a property owner desires to construct a drive after award of a contract, property owner must complete the Department’s application process via the Electronic Permit System, EPS. The property owner should contact the District Permit Office for instructions on submitting a permit application. Before any construction can begin on these drives, a permit must be reviewed and approved by the PEMS and the Contractor in writing.

Requests by property owners to place pipe across their residence or building frontage shall be submitted to the Permit Section via EPS. The property owner should contact the District Permits section for instructions on submitting a permit application. Before any construction can begin on these drives, a permit must be reviewed, authorized, and approved by the District Permits section, in conjunction with any required FHWA authorization. The PEMS should contact the AE to discuss any property owner's request for pipe placement which differs from the plan documents.

Commercial drives fall under the same general policy as private drives, although it is the normal procedure to detail commercial drives on the plans. Existing commercial drives will be revised to conform to Department standards. Additional commercial drives or changes to existing commercial drives must be submitted for authorization to the Designer of Record, the DTE, and the Permits section and include a plan sketch of the proposed commercial drive work. All submissions must be approved prior to documentation within a change order for the authorized work to be performed.

The locations of drives on limited access ROW or interstates are authorized by FHWA in coordination with the Department. Any proposed changes in the location of private or commercial drives on these types of roads will constitute the need for re-authorization.

16.2 LOCATION OF APPROACHES

Any change in location of a drive or entrance from the plans, or in the ROW grant, must initiate from a written request of the property owner The request is to be reviewed by the Engineer of Record and be authorized by CO and/or DO Permits section.

At all intersecting roads, public road approaches are to be constructed and surfaced in accordance with the Standard Drawings and SS for such approaches. The PEMS will generally find that road approaches and intersections are detailed in the plans. Each intersection should be considered individually. If a deviation from the plans, Standard Drawings, or SS is considered necessary, it should be brought to the attention of the AE and PM.

Prior to the construction of mailbox approaches, the PEMS should contact the appropriate local postal authorities to determine the route and direction of travel of the rural mail carrier. Additionally, the PEMS should contact the individual property owners regarding the location of the mailbox approaches when approach location issues arise that could cause confusion or are unclear. Locating the mailbox in conjunction with a private entrance is advantageous. Combining two or more mailboxes on one approach is recommended when feasible. In these cases, the tangent length in front of the mailboxes may be extended accordingly. By judicious grouping of mailboxes in built-up residential areas, the frequency of leaving and entering the traveled roadway may be decreased and is conducive to increased traffic safety. Many rural carriers are interested in mailbox grouping and their assistance in this matter should be requested. All proposed changes to approaches should be discussed with the AE and submitted to the Engineer of Record for concurrence prior to actual construction. The PEMS should review mailbox approaches early in the construction process so not to interfere in the timely construction of the approaches.

16.3 EXCAVATION AND EMBANKMENT

The drive length and earthwork quantities shown in the Approach Table of the plans have been established based on the Standard Drawings and the SS. With respect to Class II, Class IV, and

Class V drives, the Standard Drawings indicate desirable embankment slopes in fill and cut sections and maximum profile grades in cut and fill sections. With due consideration being given to mowing, maintenance, traffic safety, the local terrain and topography, and the identified clear zone for the contract, these indicated slopes may be modified after reviewing the issues with the AE.

If the plans indicate a private drive extending beyond the ROW line, temporary ROW will be provided for construction. However, if temporary ROW has not been provided for the extension of private drives beyond the ROW line, a right-of-entry must be obtained from the District Permits section. The PEMS should contact the PM for assistance in obtaining the right-of-entry. Should the right-of-entry be unattainable, the approach construction must be confined to the ROW limits.

16.4 SURFACING DRIVES AND APPROACHES

The materials and methods used in the construction of private and commercial drives along with Mailbox and Public road approaches are similar and are covered in the plans, Standard Drawings, and SS.

The length of the drives shown in the Approach Table is the distance the surfacing material may extend from the edge of pavement towards the ROW line. When the new drive or approach meets an existing drive within the ROW, the surface must be placed only to that point of intersection. Drives indicated in the plans to extend beyond the ROW lines will be surfaced to the point of intersection with the existing drive. Drive and approach grades modified with the property owner’s written permission will be surfaced only to the limit established by the intersection of a 10% grade with the existing driveway. Any additional surfacing required beyond this point is an obligation of the property owner.

Section 17:

Curbs and Gutters

SECTION 17 – CURBS AND GUTTERS

17.1 CONCRETE CURB, INTEGRAL CONCRETE CURB, COMBINED CONCRETE CURB AND GUTTER

Concrete curbing and combined concrete curb and gutter must be constructed prior to paving. Grade lines for the top of curb and flow line of the gutter should be established as far in advance of construction as possible, reviewed with the AE, and be approximately parallel with the centerline of pavement. Wherever possible, the elevation of the top of curb should be approximately 1/4 in. lower than the sidewalk or ground line. This lower elevation allows for drainage and prevents standing water from accumulating on the adjacent sidewalk. Curb and gutter must be constructed in accordance with the contract documents, and the PEMS must verify that positive drainage is established.

If it appears that the elevation of the top of curb will be above the sidewalk or ground line, the AE should be contacted in sufficient time to permit an inspection of the area before construction is started.

Attention must be given to the preparation and compaction of the subgrade and the setting of forms and forming of joints. Forms that are not straight, warped, or not strong enough to resist springing when concrete is deposited will be rejected. True line and grade on curb or combined curb and gutter is essential to prevent standing water. Rubbing, finishing, and curing must be in accordance with the SS.

The upper portion of integral curb may be constructed after the lower portion has been completed and cured with the adjacent pavement. Stirrup bars shall be placed as specified and the surface roughened prior to the concrete gutter curing. The gutter line should be checked with a straightedge, after the stirrup bars have been placed in the lower portion of the integral curb, to verify there are no irregularities.

Where HMA surfaces are constructed adjacent to curb or combined curb and gutter, the concrete must be adequately covered to prevent marring by the tack or HMA material during their placement.

17.2 HMA CURBING

Unless otherwise specified, the HMA material used for curbing will be as set out in Division 400 of the SS.

The machine used to place the curb is generally an extruding type machine that forces the HMA mixture through a mold conforming to the typical section. Irregular sections may be placed, formed, and compacted by hand methods.

Just prior to the placing of the HMA curb, the base must be thoroughly cleaned of all foreign material. If the HMA curb will not adhere to the base, the base must receive a tack coat, as provided in Section 605 of the SS. The Contractor must not proceed when the material is not extruding to the desired section and density. Any substandard curb must be removed and replaced at no additional cost to the Department.

Section 18

Original and Final Cross Sections

SECTION 18 – ORIGINAL AND FINAL CROSS SECTIONS

18.1 ORIGINAL CROSS SECTIONS

Original cross sections must be checked to verify that the plans accurately reflect the existing ground at the time the contract starts. Section 3 of these instructions includes remarks about obtaining original check sections, depending on whether the contract has an item for construction engineering. The PEMS should check the original cross sections as outlined in the SS and Section 3.5 of these instructions.

18.2 FINAL CROSS SECTIONS

Taking, checking, and plotting of final cross sections should keep pace with the finishing of shoulders, ditches and backslopes. Data collection for final cross sections should be obtained by Department personnel, consultants working for the Department, or Department personnel working in coordination with the Contractor and confirming the actual elevation shots and distance measurements taken by the Contractor. The Contractor's data alone may not be used for determining final pay quantities for earthwork.

When taking final cross sections, record offset information such as edge of surface, flow line of pipes, where final section crosses original ground line, grade breaks, and any other information needed to provide a clear picture after plotting the final cross section.

When starting the surveying process, start from a benchmark that was established on the original survey and then tie into all original benchmarks which can be located. In the notes, record the elevation computed for the benchmark, also the original elevation. Do not carry elevations ahead but start at each benchmark by using the original established elevation.

If an error is made in the notes, do not erase or delete the error. Instead, cross out the incorrect figure and place the correct figure above. Check all survey notes and verify they are correct. Take complete sections at all stations taken on the original survey.

If the last offset reading from centerline does not correspond within ±0.2 ft from original ground as indicated in the original sections, the reason for the deviation must be found and corrected. This may require checking in the field after final cross sections have been plotted. All sections, when plotted on the original sections, must form a closed area. When field checking is needed to close a section, make a note on original sections that the section was closed in the field.

Care should be used in sectioning and plotting final cross sections. Concise and accurate information is key.

If there has been a line change made, record the offsets from the original line in the notes so the information can be taken into consideration when plotting the final sections.

All notes should be complete, legible, and self-explanatory. Each day's set of notes should indicate the date, weather, and names of the crewmembers and their assigned duties.

Field notes help provide documentation of proper alignment and grade during construction of the contract. They provide the Department with a tool for analyzing and making construction determinations. Field notes are a permanent part of the official public record for the contract.

Section 19:

Monuments and Government Benchmarks

SECTION 19 – MONUMENTS AND GOVERNMENT BENCHMARKS

19.1 MONUMENTS AND GOVERNMENT BENCHMARKS

Monuments established for Congressional Townships and Section Corners, and any other established corners, are covered in detail in Section 2.3 of these instructions. The PEMS must follow the procedures outlined in Section 2.3 and take precautionary steps to ensure the Department has fulfilled the statutory requirements for the preservation and perpetuation of established corners.

The Department has an established system of permanent benchmarks within the State. In addition, the following governmental agencies maintain benchmark systems which may be of interest to the PEMS:

- U.S. National Geodetic Survey (NGS) [now part of NOAA]
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Geological Survey (USGS)
- U.S. Army Corp of Engineers (USACE)
- Indiana Flood Control and Water Resources System.

Normally, these benchmarks will be identified in the original survey and included within the contract plans. However, there are occasions when a benchmark is discovered in the field that has not been included in the plans. Under these conditions, the PEMS should follow the procedure below.

Upon discovering that a benchmark must be moved, the PEMS will contact the agency involved, stating the necessity for the move and providing the benchmark's designation. The DCD, AE, DDC, and PM should be copied in this correspondence. The designation consists of the letters and numbers stamped on the disk. It is desirable to furnish a photograph of this information in the correspondence.

Upon receipt of this information, the agency involved will provide instructions necessary for the establishment of the new benchmark and the transfer of elevation. The intent, in most cases, is to establish a new benchmark in a safe nearby location and transfer the elevation from the old benchmark to the new one. All elevation readings will be made to three decimal places to preserve the accuracy of the original elevation. An assumed elevation for the old benchmark may be used in the transfer, since the primarily concern is the relative difference in elevation between the old and new benchmarks. The old benchmark should not be disturbed until the observer or the recorder for the involved agency has verified the measurements involved in the transfer.

After the new mark has been established and the elevation transferred to it, the old disk should be broken out and returned to the agency if requested. A complete report on the action taken, including a description of the location where the new benchmark is established and a copy of the field notes involved in the transfer of elevation, should also be forwarded.

Section 20:

Sodding, Seeding, and Landscaping

SECTION 20 – SODDING, SEEDING, AND LANDSCAPING

20.1 SODDING

Sod is generally placed on slopes steeper than 3:1, in front of dwellings with maintained lawns, in ditches with grade of 1% or over, and in areas where mulch seeding will not perform satisfactorily. Sod placed on steep slopes must be pegged to keep the material in place until the root system becomes more established in the soil. The surface on which the sod is to be placed must possess sufficient depth below adjacent areas so newly laid sod will be level with the surrounding surface.

All soil on which sod is to be laid must be treated with fertilizer as designated in the SS and Special Provisions of the contract. Sod laid during the months of June, July, and August is subject to the following conditions:

1. Sod must be in good, live, and growing condition at time of cutting.

2. Sod must be placed within 36 hours after cutting and protected from damage during that period.

Winter sodding will be permitted when the temperature is above 35°F, and when both the sod and soil are not frozen. Sod must be properly protected from drying out and must be laid within 48 h after cutting.

The cost of furnishing and placing fertilizer used in sodding is included in the price per square yard of sod and is not paid as a separate item. Water is not paid as a separate item unless it is ordered by the PEMS after the initial 30-day maintenance period.

20.2 SEEDING

Seeding is utilized on prepared grade to control erosion of the soil and provide a pleasing appearance once established. Sections of bare earth and the length of their exposure to erosion should be minimized. Large cut and fill slopes should be seeded in stages as soon as they are finished. Taking time to include seeding operations as soon as possible, as often as possible, can help to reduce soil erosion. This process will prevent time lost to redress slopes after rain events.

Temporary seeding is applied prior to permanent seeding as a temporary stormwater control feature. This operation is usually performed one or more times during the contract as graded areas are completed or nearly completed. This involves the moving in and out of the seeding equipment in a disjointed fashion as opposed to the massive, one time application associated with the permanent seeding operation. Bare soil shall not be left inactive for more than seven calendar days without temporary stabilization in accordance with 205 of the SS.

There are two types of seeding consisting of plain seeding and mulched seeding. The only difference between the two types is a mulching material is placed on areas where mulched seeding is required based on the requirements of the contract documents.

Seeding may be paid for as mulched seeding by the square yard, or as separate bid items for seed by the pound, fertilizer by the ton, and mulching material by the ton. The PEMS must review the CIB for each contract, as different projects may require different quantities of seed and fertilizer.

All seeding operations require inspection to verify correct quantities, proper mixing of seed, correctly prepared seedbed, and any additional details to include in daily reports.

When hydro-seeders are used, fertilizer and seed must be applied with enough water to ensure a dampening effect. This provides a visual means of inspection for even distribution over the area to be seeded.

Contractors and subcontractors may experience difficulty obtaining the specified 12-12-12 fertilizer and request substitutes. All allowed substitutes must be a balanced mix, such as 10-10-10. The application rate for these substitutes must be adjusted to compensate for any change in the components. Application of fertilizer will be based on the rate of 400 lb/ac for seeding and sodding unless otherwise specified in the contract or directed.

For example, a change from 12-12-12 to 10-10-10 for 1 acre of seeding would mean the application of 1ac x (12/10) x 400 lb/ac = 480 lbs of fertilizer, but only 400 lbs would be paid for. In other words, areas where extra fertilizer is applied, the pay quantity using 10-10-10 would be 10/12 of the quantities applied. Accurate records must be maintained of all the fertilizer used and recorded in the contract records. The computations converting the total actual quantity used to an equivalent tonnage of 12-12-12 must be shown for the final payment.

If seeding is to be paid for by separate bid items, the PEMS must verify the quantity of seed used is recorded each day and properly reported. It will be permissible to count sacks of seed and fertilizer used each day, then multiply the number of sacks by the weight of one sack to get the daily record for seed and fertilizer. It is best to keep accurate records of all fertilizer delivered to any contract, then deduct the amount of fertilizer used in sodding to get correct quantities for separate pay items used in seeding.

Mulching material is paid for by the ton and each truckload must arrive on site with a weigh ticket. Representative samples must be taken from the mulching material to determine the amount of moisture in the material. These samples are to be weighed at time of delivery, then re-weighed when the mulching material is dry. The difference between these two numbers will determine the moisture content. To determine moisture, the sample is placed in a large burlap sack and then placed in a suitable location to dry. The PEMS should reference the Division of Materials and Test's Manual for Frequency of Sampling and Testing and Basis for Use of Materials to help determine the number of mulch samples required. It is the responsibility of the PEMS to see that all samples are taken, and documentation recorded.

The PEMS should verify the required amount of mulching material is placed and that it is uniformly distributed over the area to provide proper coverage. When too much mulch is placed, it retards the growth of the vegetation. Too little mulch will not provide sufficient protective cover for the seed.

Adequate provisions for holding the mulching material in place, such as punching the mulch into the soil, are likewise important. Unless the mulching material is retained in place, winds or moving traffic adjacent to the pavement edge will displace it. Once displaced, mulching provides little protection for the seeding and allows erosion of the grade to progress.

There are several approved hold down methods that provide satisfactory results. The PEMS and the Contractor should discuss the proposed method of spreading and holding mulch in place prior to beginning seeding operations.

Normally, all areas inside slope stake locations which are not surfaced or sodded should be seeded. These areas include the radii at the top of cut slopes and bottom of fill slopes.

Seeding without mulch must not be performed between May 1 and August 15. For permanent seeding performed from October 16 through January 31, the Contractor is required to post a warranty bond. The Department will make the determination to release a Contractor from the warranty. This determination will be made within 10 calendar days after a documented request for inspection has been received from the Contractor, but will not be made prior to April 1.

The PEMS should go over the contract with the AE to determine where to place sod and seed well in advance of the Contractor starting work operations on these items.

The PEMS should verify that all seed has been tested and approved in accordance with 914 of the SS. Discuss seed requirements with the Contractor well in advance of seeding operations to avoid unnecessary delays.

20.3 LANDSCAPING

Landscaping contracts are to be administered the same as other construction contracts. This process would include the same supervisory checks such as weigh tickets and payrolls, when minimum wages are applicable. ES should be informed of the time and place for pre-construction conferences so arrangements can be made for a representative of the landscaping section to attend. The PEMS should study the contract provisions and SS carefully prior to starting work. All alternate sources of planting material must be approved by prior to use.

Tree plantings and shrubs must comply with the clear zone policy (distance from the edge of the driving lane to an obstruction) as outlined in the Roadside Safety Section of the AASHTO Roadside Design Guide.

Storage of equipment and materials should be stored 30 ft of the pavement edge for sections not protected with guardrail or other suitable barrier. These distances are considered as minimums. Where sufficient ROW is available and field conditions indicate greater clearance is needed for safety, the minimal distances should be increased. For areas protected by guardrail or other suitable barriers, storage of equipment must be in accordance with 107.08.

Lance watering of planted material is not allowed. Backfill and mulch are not direct pay items. Backfill material within 6 in. of the plant root ball must comply with the Standard Drawings and SS. Mulch must be placed to the depth and diameter specified. Guying and staking should be performed strictly in accordance with the plans, Standard Drawings, and SS to protect against damage to the plant, such as rubbing.

Landscape work and procedures are subject to frequent change and revisions. Therefore, the PEMS should refer to RSPs and USPs pertaining to their particular contract and be aware of and understand all current instructions for contract landscaping. ES is available for technical advice and interpretations and should be contacted when help is needed. “As built” plans are to be prepared and retained for all landscape contracts. They should identify any changes made during construction.

The Contractor must observe all State, Federal and local regulations and quarantines pertaining thereto, in accordance with 107.01 of the SS. The regulations and quarantines referenced pertain to harmful pests such as, but not limited to, various types of beetles. The quarantine applies to landscape plants, soils, sod, and all earthmoving equipment being used on the contract. When these items are moved from a generally infested location to a location considered to be less infested, a proper permit or certificate must be obtained. Maps indicating the regulated areas are distributed to the DO. It is the responsibility of the PEMS to determine when a certificate is required and that it is furnished. The DO and ES should be consulted for additional information.

The Contractor shall furnish landscaping materials accompanied by the proper certificate or permit when applicable. For landscaping material furnished to the Contractor by a commercial nursery, the nursery shall provide the required certificate to the Contractor. Out of state nurseries will provide the required certificate by cooperative agreement between the States. For material from a private source, such as sod from a farmer, the Contractor must contact IDNR, Division of Entomology and Plant Pathology at: https://www.in.gov/dnr/entomology/ for the location of a State or Federal inspector to secure the certificate if the PEMS or DO is not able to furnish an inspector’s name.

The PEMS should obtain copies of the required certificates or permits for all quarantined materials. This also applies to earthmoving equipment being moved from infested areas. These copies should be retained in the contract file.

20.4 MOWING AND HERBICIDE CONTRACTS

The Contractor must understand the exact areas to be mowed or treated with herbicides. This topic must be discussed and agreed upon at the pre-construction conference. If problems arise with interpretation of the contract areas to be treated, the PM and CM should be contacted immediately. The Contractor will be notified to begin each mowing cycle.

20.5 PLANTS AND SEEDLINGS

The Contractor must submit a list with the name and location of the source of plants to the PEMS. Once received, the PEMS will forward this list to ES for approval. The plants should not be placed until approval has been obtained.

The Contractor should choose a Pre-qualified source for seedlings for immediate use. If the source for seedlings is not pre-qualified, the same procedure will be followed as stated above for approval of plants.

Section 21:

Guardrail, End Treatments, Impact Attenuators, and Delineators

SECTION 21 – GUARDRAIL, END TREATMENTS, IMPACT ATTENUATORS, AND DELINEATORS

21.1 GUARDRAIL

When guardrail or delineators are used, they must be placed as shown on the plans and the material must comply with the SS. The guidance for the type and location of guardrail is subject to change and the PEMS must be aware of the provisions included as a part of the contract documents. Guardrail should never be placed where current guidance does not dictate its use as the guardrail itself could constitute a hazard.

The height of guardrail is an important element of design and placement. For the guardrail to function properly, the PEMS should verify that guardrail is placed at the proper height based on the Standard Drawings. When existing guardrail is to remain in place, the PEMS should check the Standard Drawings and SS to determine if minimum height requirements are met. If there is a discrepancy in the minimum height in the field compared to that indicated within the Standard Drawings, the AE should be contacted for further discussion.

21.2 GUARDRAIL END TREATMENTS AND IMPACT ATTENUATOR

Guardrail end treatments (sometimes called end terminals) are energy-absorbing safety devices used to protect the exposed end at the beginning run of guardrail. One common treatment is designed to absorb the energy of a crash by having the impact head slide down the length of the guardrail. Treatments should be installed at the locations shown on the plans and selected from the Department's Qualified Products list.

Impact attenuators (often called crash cushions) are also energy-absorbing safety devices but are used to protect a significant structure such as a bridge pier or concrete barrier wall end. A frequently used device is a sand or gravel-filled attenuator which consists of barrels filled with sand or gravel meant to absorb crash energy. Attenuators should be installed at the locations shown on the plans and selected from the Department's Qualified Products list.

Certification to assemble, repair, and install guardrail end treatments and impact attenuators is required by the Department for construction contracts. Contractor personnel must be certified prior to repair and installation. Certified Installers are listed on the Departments website. Quality assurance inspection of the device by certified Department personnel is required after installation by the Contractor.

21.2.1 Certification Process

To become certified on a specific unit, personnel must attend and pass a certification training provided by the Manufacturer of the device. The Department will provide the Manufacturer's training resources, found on the Department's website, with either an on-demand video or redirecting to the manufacturers' training website.

Once an individual is certified and receives a form of certification from the Manufacturer, it is the responsibility of that individual to provide the form of certification to Construction Management for recording. It is up to each District Office to determine which field personnel will be certified for each unit.

For more information, refer to the following Department website: INDOT: Doing Business with INDOT: Guardrail End Treatment and Impact Attenuator On-Demand Training for Installers

21.2.2 Quality Assurance Inspection Procedures

Confirming Certification. Construction personnel that have devices to be installed on their projects are required to verify on the Department's website listed above that at least one member of the crew, typically the foreman, is certified to install the device specified in the contract documents.

Request for Certified Inspector. Once a device is installed, replaced, or repaired, the PEMS should immediately notify their AE and request a certified Department inspector to visually inspect the device. The communication should include device type and location.

Device Inspection. The certified Department inspector will perform a visual inspection to verify that the device was installed correctly. This QA inspection will be performed within 15 calendar days of the PEMS' request.

AWP Requirements. The following should be recorded within an AWP Daily or Diary:

- Type of device installed, replaced, or repaired
- Location of device
- Name of Contractor's crew member who is certified to install device
- Name of Department's certified inspector who performed the QA inspection.

Follow up Corrections. If it is determined that there is a problem with the installation, the Department certified inspector will notify the PEMS and AE. The Contractor will then be notified of any deficiencies found during the QA inspection. The Contractor shall remobilize to the site, provide proper traffic controls, and correct all problems at no additional cost to the Department.

The following should aid a non-certified PEMS witnessing the installation of a specific device. These are some basic items to be aware of when inspecting to ensure proper installation.

Guardrail End Treatments

- Cables must be taut with brackets properly engaged
- Blockouts and posts must not be damaged
- All bolts and nuts must be snug
- Ground under and in front of device must be free of damaging or disruptive debris
- Delineation panel must be securely attached and free of damage.

Sand or Gravel Barrel Attenuators

- Barrels must show no sign of cracks
- All lids must be locked down and secured
- Ground under and in front of device must be free of damaging or disruptive debris
- The level of the sand or gravel within the attenuators should be checked by a certified inspector for the proper height.

Impact Attenuators

- Cables must be taut and not sagging
- Diaphragms and bays must have a straight alignment
- All rail panels must be tight and not damaged
- Cartridge/rip plates must not be damaged
- Cylinders must show no signs of cracking
- All bolts and nuts must be snug
- Ground under and in front of device must be free of damaging or disruptive debris
- Delineation panel must be securely attached and free of damage.

21.3 DELINEATORS

Normally, construction plans will indicate the placement of delineator posts. Post locations are planned for sub-surface drain outlets, shoulder edge delineation, and at hazardous locations such as sharp curves, steep grades, or lane reduction transitions. When determining where delineators should be used, designers review the location of the contract and prevailing topography to help determine what would constitute a sharp curve or a steep grade.

The spacing for delineators should match those shown in the Indiana MUTCD. Any spacing details requiring additional clarification should be referred to the DTE.

Section 22:

ADA Compliance for Sidewalk, Curb Ramps, Blended Transitions, and Pedestrian Facilities

SECTION 22 – ADA COMPLIANCE FOR SIDEWALK, CURB RAMPS, BLENDED TRANSITIONS, AND PEDESTRIAN FACILITIES

22.1 SIDEWALKS AND CURB RAMPS

22.1.1 Regulations

When constructing pedestrian facilities (sidewalk, trail, non-vehicular use facility), the requirements of the Americans with Disabilities Act (ADA) must be met regardless of the contract's funding source. Exceptions to these requirements require a determination of technical infeasibility, issued by the Highway Engineering Division in conjunction with the Department's Title VI Program and FHWA. The intent is that technical infeasibility is determined prior to construction.

If the plans do not accurately reflect the field conditions encountered, particularly when curb ramps are involved, the PEMS should discuss the situations with the AE and the Designer to examine alternative solutions. "Doing the best you can" is not sufficient for ADA compliance. The Department's ADA Technical Advisory Committee, TAC, can provide technical assistance (ADA@indot.in.gov). During the contract, if an alternative that meets the ADA requirements cannot be found, the PEMS should have the Designer document the alternatives considered and request a determination of technical infeasibility from the TAC. The Indiana Design Manual, IDM, describes this process. Work should not continue until a determination has been made.

Indiana Design Manual

IDM Chapter 51 contains information on ADA, curb ramp, sidewalk, and pedestrian pushbutton requirements. IDM Chapter 17 contains information on curb ramp quantities.

Note: Effective with September 2016 lettings, curb ramps are no longer paid for by a type. Designers should be detailing all curb ramps on contract's construction plans.

INDOT Standard Specifications

- 604 Sidewalks, Curb Ramps, Steps, and Handrails
- 805 Traffic Signals
- 905.05 Detectable Warning Surfaces.

INDOT Standard Drawings

- 604-SWCR Sidewalk Curb Ramps
- 604-SDWK Sidewalk Details
- 801-TPAR Temporary Pedestrian Access Routes
- 805-PPBA Pedestrian Pushbutton Assembly.

ADAAG vs. PROWAG

The 2010 ADA Standards for Accessible Design (2010 Standards) is the current standard for providing facilities that are readily accessible and usable by persons with disabilities. However, the guidelines were developed primarily for buildings and facilities outside the ROW. Pedestrian facilities within the public ROW contain elements to which the 2010 Standards cannot be readily applied. For this reason, the U.S. Access Board proposed guidelines specifically for pedestrian facilities in the public ROW denoted as the Public Rights-of-Way Accessibility Guidelines, PROWAG. These guidelines are recommended as best practice by FHWA and are currently being evaluated as part of the federal rulemaking process. Once adopted as a regulation, with or without modifications, the guidelines will be mandatory. The PROWAG has been used to develop the Department's ADA transition plan and should be used as the basis for identifying the required curb ramp, landing (turning space), and sidewalk dimensions and slopes (running slopes and transverse slopes).

Changes from ADAAG to the PROWAG

Very little has changed from the Americans with Disabilities Act Accessibility Guidance, ADAAG, to the PROWAG. The items listed below represent notable differences.

1. The minimum clear width of a curb ramp, turning space, or sidewalk, is 4 feet. A 3-ft pinch point is not acceptable. For sidewalks, where the width is less than 5 ft, a 5 ft by 5 ft passing space is required every 200 ft.

2. The grade (running slope) of the sidewalk shall not exceed the adjacent roadway profile grade.

3. A curb ramp running slope of 10% for a 6-in. rise is not acceptable.

4. A sidewalk adjacent to a roadway does not require a landing or handrail, regardless of the roadway grade.

5. Detectable warning elements must extend the full width of the ramp. Where forming is required, a 2-in. maximum border width may be provided. Only the clarification where a border is necessary is new.

Changes from previous Department practice

Much has changed from previous Department practice. The items listed below represent notable differences.

1. Designers have been directed to fully detail curb ramps on contract construction plans. Simply calling out a ramp by type, e.g. Type A, is not acceptable. Spot elevations, widths, and slopes should be shown or tabulated.

2. **There is no construction tolerance for cross slope.** The maximum cross slope is 2.00%. The PROWAG contains exceptions to cross slope requirements for ramps and turning spaces when matching the grade of the adjacent roadway. Designers have been directed to use no more than 1.5% as a design value. The IDM now states this explicitly. A 2-ft level is also identified for checking compliance. *Note: A 2-ft level is not required by PROWAG but was included so that the expectation was clear. Forms should be checked prior to pour to ensure maximum slopes are not exceeded and minimum dimensions are met.*

3. **There is no construction tolerance for running slope.** The maximum ramp running slope is 8.33%. Designers have been directed to use no more than 8.0% as a design value. The IDM now states this explicitly. *Note: A 2-ft level is not required by PROWAG but was included so that the expectation was clear. Forms should be checked prior to pour to ensure maximum slopes are not exceeded and minimum dimensions are met.*

4. The Standard Drawings identify curb ramps as either perpendicular or parallel.

5. All curb ramps are paid for as a single pay item Curb Ramp, Concrete.

6. Detectable Warning Surfaces, DWS, (truncated domes) are paid for separately. The area of DWS is not subtracted from the Curb Ramp, Concrete quantity.

22.1.2 General Construction Notes

1. Sidewalks are usually replaced when they are disturbed or removed during construction. Sidewalks beyond the construction limits, which are damaged by the Contractor’s equipment, must be replaced at no cost to the Department. Sidewalks built adjacent to curbs should be constructed 1/2 in. above the curbs to reduce the potential for ponding on the sidewalk along the top of the curb.

2. Pedestrian accessibility is required to be provided and maintained during the construction of the contract where facilities currently exist. Accessibility consists of signed pedestrian detours utilizing existing and temporary features including curb ramps, DWS, pedestrian signals, pavement markings, pedestrian phasing, or sidewalks, affected by the work zone. The PEMS should review the contract plans to identify the methods to be used for pedestrian access.

3. Sidewalks placed at drives shall be 6 in. thick or the same depth of the existing drive, whichever is greater.

4. When reconstructing portions of sidewalk, the joint pattern of new sidewalk should be similar to sidewalk intended to remain in place.

5. The height of a single two-by-four (3 1/2 in.) is not acceptable as a form.

6. Forms should be checked prior to a pour to ensure maximum slopes are not exceeded and minimum dimensions are met.

7. Construct sidewalks only where indicated on the plans unless a change is authorized.

22.2 CURB RAMP BASICS

Curb ramps and turning spaces are part of the Pedestrian Access Route (PAR) and must meet ADA standards. The Department separates curb ramps into component and design elements.

22.2.1 Components

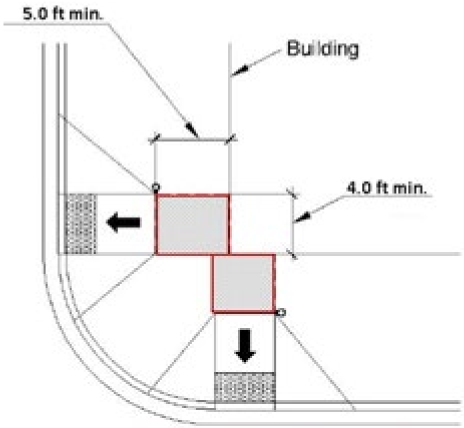
The PROWAG section reference is shown in brackets adjacent the component description below.

1. <u>Ramp or Blended Transition [R304.1].</u> The ramp or blended transition is the portion of a curb ramp that facilitates the change in elevation from the sidewalk to street level. Typically, the curb ramp cuts through or is built adjacent to the curb. Although similar, ramps leading to or within buildings are subject to separate requirements [R407].

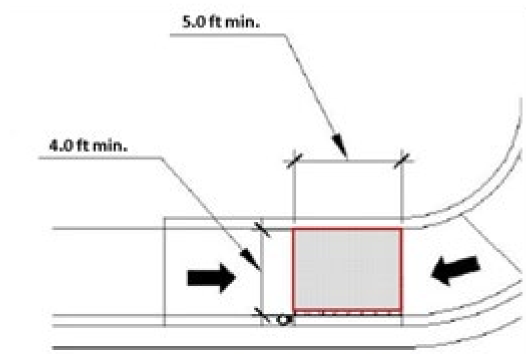
2. <u>Turning Space [R304.2.1]</u>. A turning space or landing area must be provided at the <u>top of a perpendicular curb ramp</u>, the <u>bottom of a parallel curb ramp</u>, and where the pedestrian access route changes direction. It is acceptable for two perpendicular curb ramps to share a common landing.

   <u>Minimum dimensions:</u> 4 ft by 4 ft. Where the turning space is constrained by a curb, building, or other feature at the back of the sidewalk, the minimum required dimensions are 4 ft by 5 ft, with the 5-ft dimension in the direction of the ramp run.

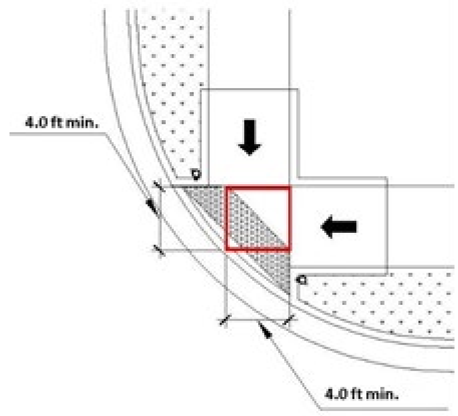
   <u>Quantities:</u> The turning space is included in the SYS cost of the concrete curb ramp. Where turning spaces overlap, the area should only be included once.



Perpendicular Ramp Turning Space



Parallel Ramp Turning Space

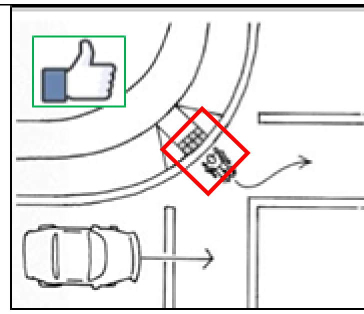


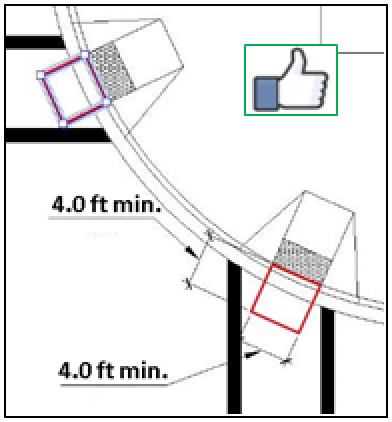
Overlapping Turning Space

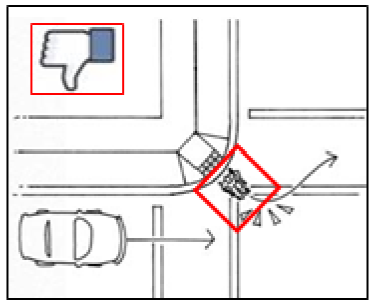
3. Clear Space [R304.5.5]. The clear space is provided beyond the grade break at the bottom of a ramp to allow a wheelchair user to maneuver and align with the crosswalk. The clear space requirement requires particular attention at diagonal ramps and other locations where the ramp run is not in line with the direction of pedestrian travel.

   Minimum dimensions: The minimum required dimensions are 4 ft by 4 ft. The clear space should be within the width of the pedestrian crossing and wholly outside the parallel vehicle travel lane. The parallel vehicle travel lane is the lane where traffic is traveling parallel to the crosswalk.

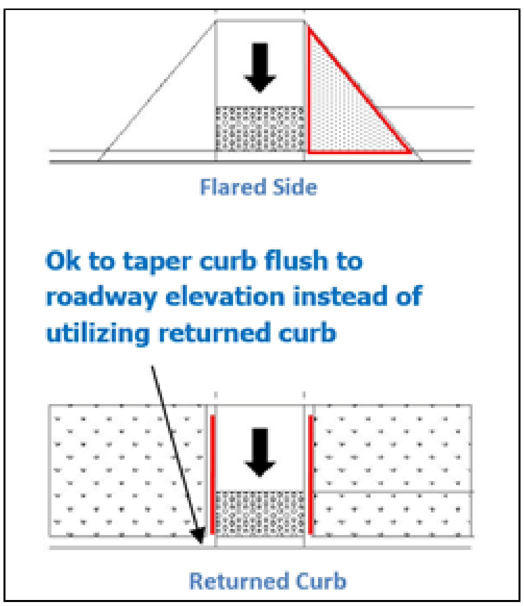
   Quantities: The clear space is not quantified separately.







4. Flared Sides and Returned Curbs [R304.2.3].



a. Flared Sides. Required where the curb ramp intersects a sidewalk or other walkable surface. The maximum allowable slope is 10.0%.

b. Returned Curbs. May be used instead of flared sides where the curb ramp intersects a buffer, sodded area, or other non-walkable surface or where protected from cross travel by landscaping, street furniture, fencing, or railing. Return curbs assist pedestrians with low vision find their way.

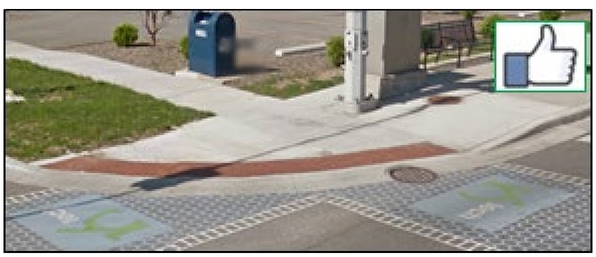
Quantities: Both flared sides and returned curbs are included in the SYS cost of the concrete ramp.

5. Detectable Warning Surfaces, DWS [R305.1]. DWS consist of truncated domes aligned in a square or radial grid pattern and must extend the full

width of the curb ramp. The Designer must show the DWS the full width of the ramp. The Contractor chooses the DWS from the Department's Qualified Products List. Brick DWS will require some type of forming. A 2 in. concrete border can encroach into the ramp width, but any additional width must be outside the ramp. An L-bracket or other means of restraint is also acceptable.

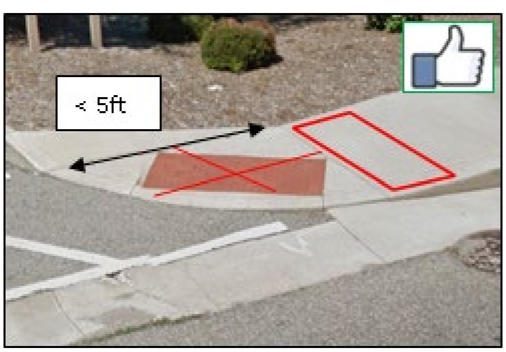
DWS must contrast visually with the adjacent gutter, street, or pedestrian access surface. Each curb ramp must contain a detectable warning surface except as follows.

Where the cut through pedestrian refuge island is less than 6 ft in the direction of pedestrian travel, detectable warning surfaces should not be placed as there is not sufficient distance between surfaces to distinguish the boundary between pedestrian and vehicular routes.

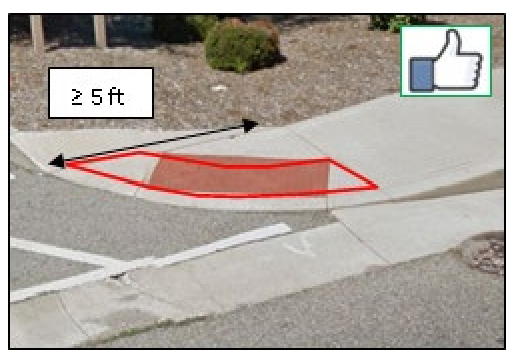


Detectable Warning Surface is the full width of the ramp.

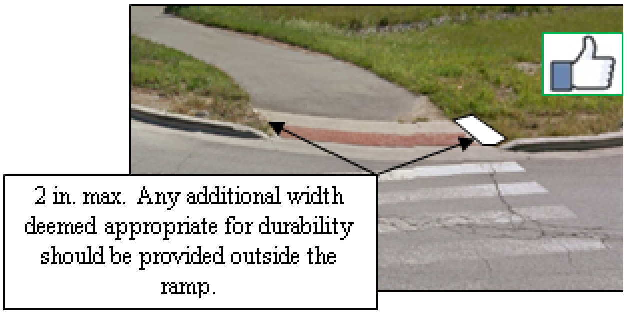
Detectable Warning Surface is not the full width of the ramp. See below for possible solutions.



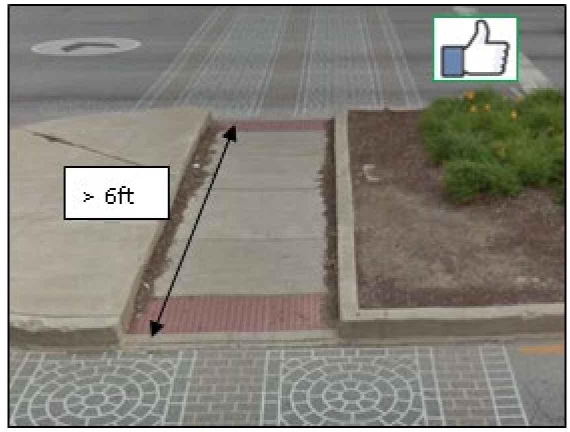
Solution 1. DWS may be located at the bottom of the ramp when located less than 5 ft from back of curb.



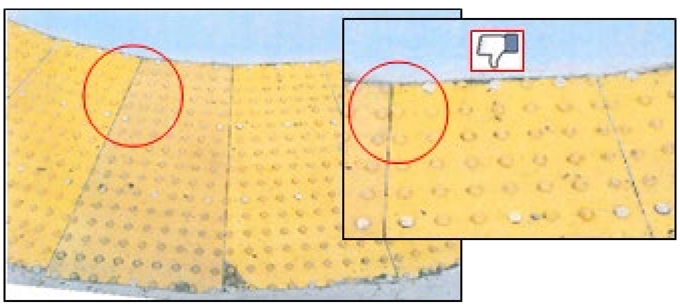
Solution 2. DWS should be in a radial pattern beyond the ramp when the bottom of the ramp is greater than or equal to 5 ft from the back of curb.



For a shared-use path, the DWS should extend the full width of the path, regardless of the inclusion of a ramp.



Use DWS in a median cut-through only when median width is 6 ft or greater. Do not use DWS when width is less than 6 ft. When the width is < 6 ft, there is not enough space between each DWS to distinguish the boundary between pedestrian and vehicular routes.



Where DWS are field cut, particular attention must be paid to ensure the dome spacing is within the allowable range shown on the Standard Drawings.

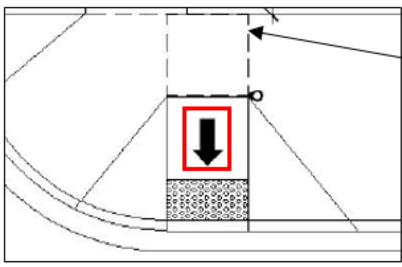
__Design Elements.__ Design elements are characteristics of the various components. The PROWAG section reference is shown in brackets adjacent to the component description below.

6. Width [R304.5.1]. The minimum clear width of a curb ramp (excluding flared sides) or blended transition is 4 ft. The minimum width for a cut through in the median is 5 ft.

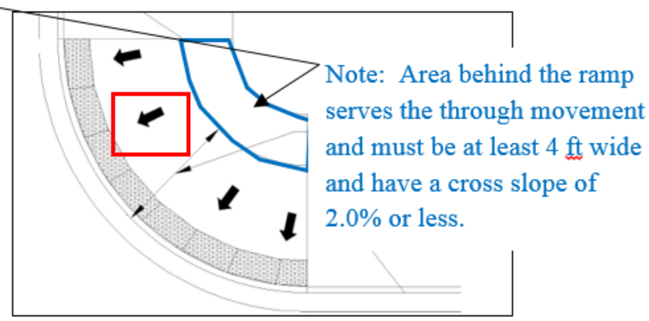
   When ramp or blended transition is used with a shared-use path, it is the width shall match the shared-use path.

7. <u>Running Slope [R304.2.2 and R304.3.2]</u>. The running slope of a ramp is measured parallel to the direction of pedestrian travel. Providing the least slope possible is preferred, and there is no construction tolerance.

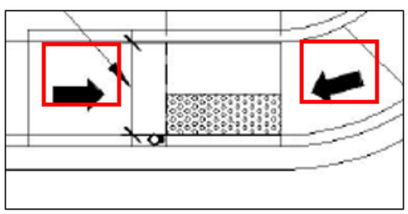
- Curb Ramp. Running slope of 8.33% maximum. 8% should be used for design.
- Blended Transition. Running slope of 5.00% maximum.
- Running slope of 2.00% or less.



Perpendicular Ramp Running Slope



Blended Transition Running Slope

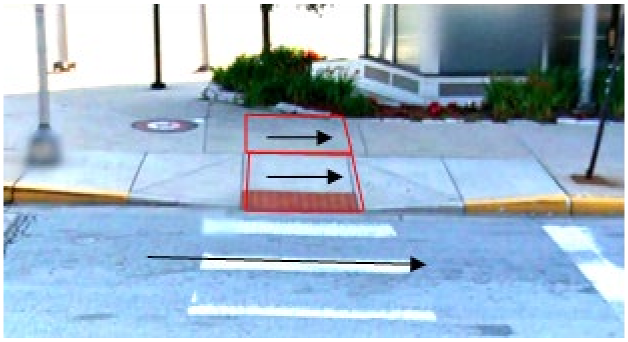


Parallel Ramp Running Slope

8. Grade Break [R304.5.2]. The grade break at the top and bottom of a curb ramp must be perpendicular to the direction of the ramp run. It may be necessary at corner with a larger radius to indent the grade break from the back of the curb meet this requirement. Grade breaks are not permitted on the surface of the ramp run or within the landing area.

9. Cross Slope [R304.5.3]. Cross slope measured perpendicular to the direction of pedestrian travel. The maximum allowable cross slope of a curb ramp, turning space, or clear space is 2.0% with the exceptions below permitted at crosswalks. A slope of 1.5% should be used for design purposes.

   At a crosswalk, it may be acceptable for the cross slope to exceed 2.0% without a determination of technical infeasibility. See Sidewalk and Crosswalk Basics cross slope information.



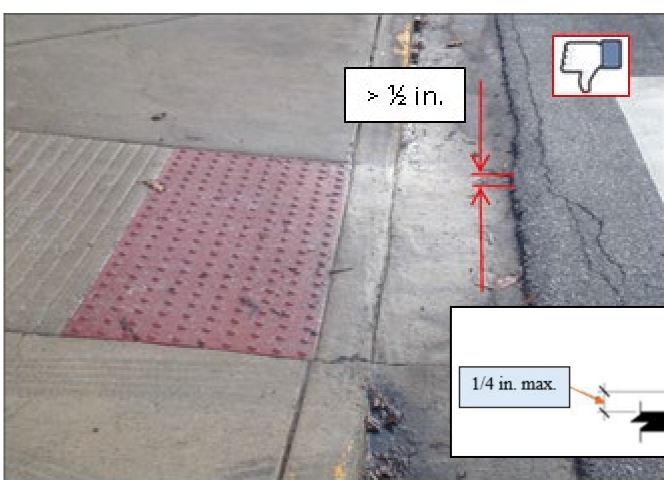
***At a street crossing, cross slope of ramp and turning space may be >2% to meet roadway grade. If crossing is signalized or has no traffic control, max is 5%. If crossing is stopped condition, max is 2%. If crossing is a midblock crossing, max is the roadway grade.**

Roadway grade >2%

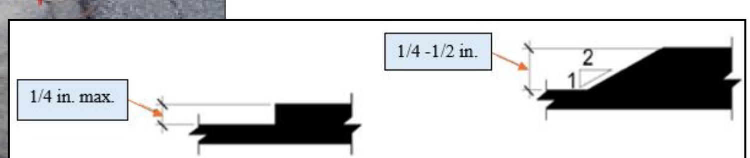
10. Counter Slope [R304.5.4]. The counter slope is a slope opposite to the general running slope of the ramp or sidewalk, typically the cross slope of the gutter or roadway at the foot of the curb ramp or blended transition. The counter slope must not exceed 5%. This maximum allows the rate of grade change not to exceed 13% when the maximum ramp running slope is used. Excessive rate of grade change compromise the ground clearance of a wheelchair footrest and may cause a wheelchair to tip.

    Where the rate of grade change exceeds 11% but less than 13.33%, a 2 ft level area (equal to or less than 2.00% slope) should be provided on the ramp, adjacent to the counter slope.

11. Vertical Surface Discontinuities [R302.7.2]. Where a curb ramp meets the roadway, the surface should be flush. Along the Pedestrian Access Route (PAR), surface discontinuities greater than 1/2 in. are not acceptable. Discontinuities of 1/4 in. and less are acceptable with no additional modifications. Discontinuities greater than 1/4 in. to 1/2 in. must be beveled.



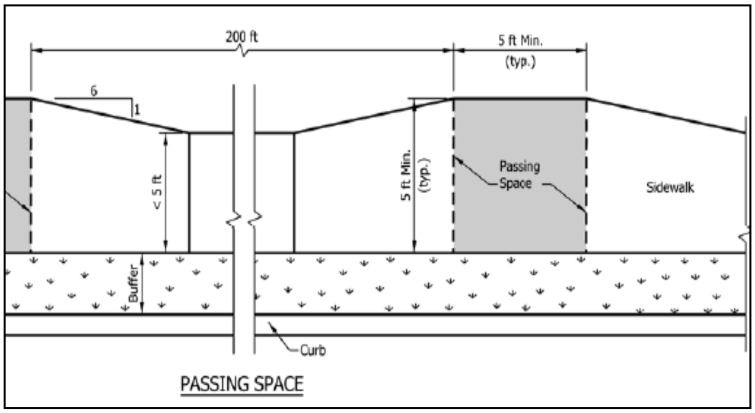
This curb ramp is flush at the curb line, but an overlay has created a vertical discontinuity which is greater than acceptable limits as shown below.



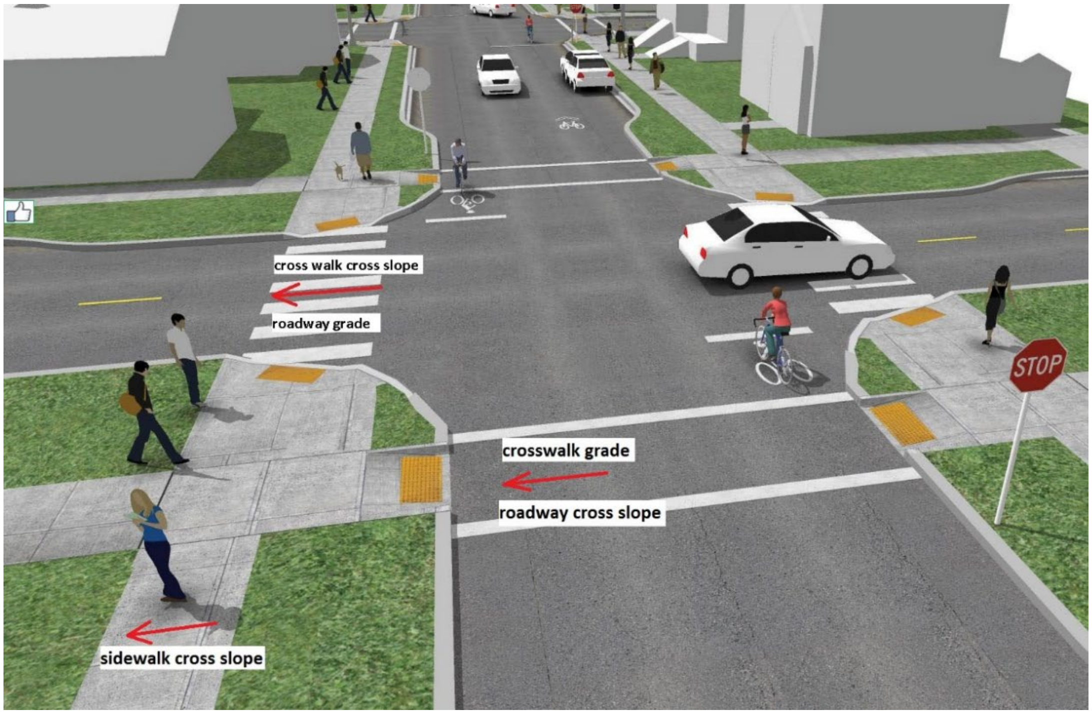
22.3 SIDEWALK AND CROSSWALK BASICS

Sidewalks and crosswalks are part of the Pedestrian Access Route (PAR) and must meet ADA standards.

1. Width. Minimum clear width of 5 ft. Where a 5 ft clear width is not provided, passing spaces of a minimum of 5 ft by 5 ft must be provided every 200 ft.



Where street furniture, utilities, or other obstructions are present on the sidewalk, a clear width (measured between obstructions or from the obstruction to the back of curb or sidewalk) can be 4 ft. The minimum 4 ft dimension is for pinch points only and should not be used as a continuous width.



2. Cross Slope (measured perpendicular to the direction of pedestrian travel).

Sidewalk. Maximum 2.0%. A slope of 1.5% should be used for design. The cross slope requirements still apply where the sidewalk crosses a driveway. The sidewalk cross slope takes precedence over the driveway grade. The driveway approach can be built on a varying grade to ensure the sidewalk cross slope does not exceed 2.0%.

Crosswalk

- Pedestrian street crossings (crosswalks) with stop sign or yield sign = 2.0% maximum.
- Pedestrian street crossings (crosswalks) without yield or stop control, e.g. signalized = 5% maximum.
- Midblock crossing only = Maximum of grade of street or highway being crossed.

3. Grade (measured parallel to the direction of pedestrian travel).

   Sidewalk. Maximum grade cannot exceed the grade of the adjacent roadway.

   Crosswalk. Matches the cross slope of the roadway.

22.4 PEDESTRIAN PUSHBUTTON BASICS

The placement and configuration of the pedestrian pushbutton assembly is critical to proper function. Criteria for pushbutton placement are listed below. If these criteria cannot be met, a Technical Inquiry must be sent to the ADA TAC for review. Variations in curb radius, available right of way, presence of a buffer or curb ramp, and existing infrastructure make each crossing unique.

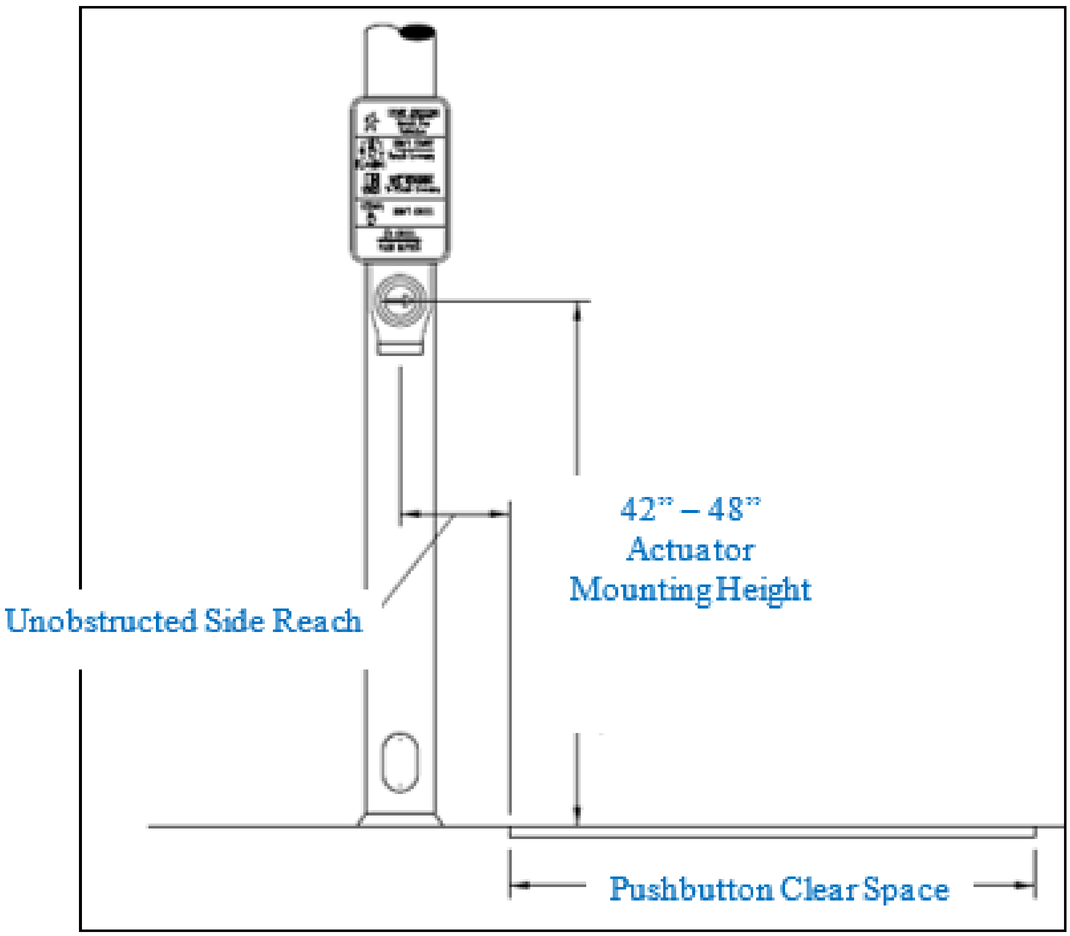
1. Placement. The MUTCD 4E.10 provides guidance on the location of pedestrian pushbuttons. The distance from the nearest face of a pushbutton assembly to face of the curb or edge of pavement should be between 1.5 ft and 6 ft and should not be greater than 10 ft. Placement that falls outside these guidelines should be documented as a Technical Inquiry with the ADA TAC.

   Placement of push buttons should be adjacent to the clear space and within reach requirements discussed below.

   Where two APS pushbutton assemblies are closer than 10 ft., special features must be included in accordance with IMUTCD 4E.10 and sections 805 and 922.04(b) of the SS.

2. Side Reach. The maximum unobstructed side reach distance is 10 in. Designers should be mindful of guardrail, curb, or other obstructions that may affect the available side reach. Pushbutton extensions up to 12 in. may be used to meet the side reach requirements.

3. Mounting Height. The actuator must be mounted between 42 and 48 inches above the Pedestrian Access Route.

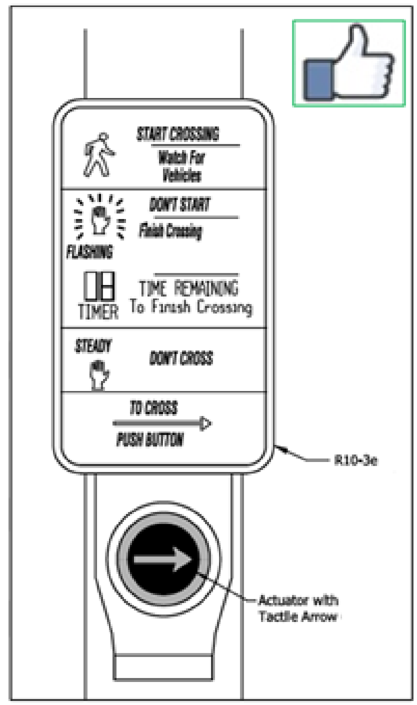


4. Pushbutton Clear Space. A clear space, similar to a curb ramp turning space must be provided adjacent to the pushbutton assembly.

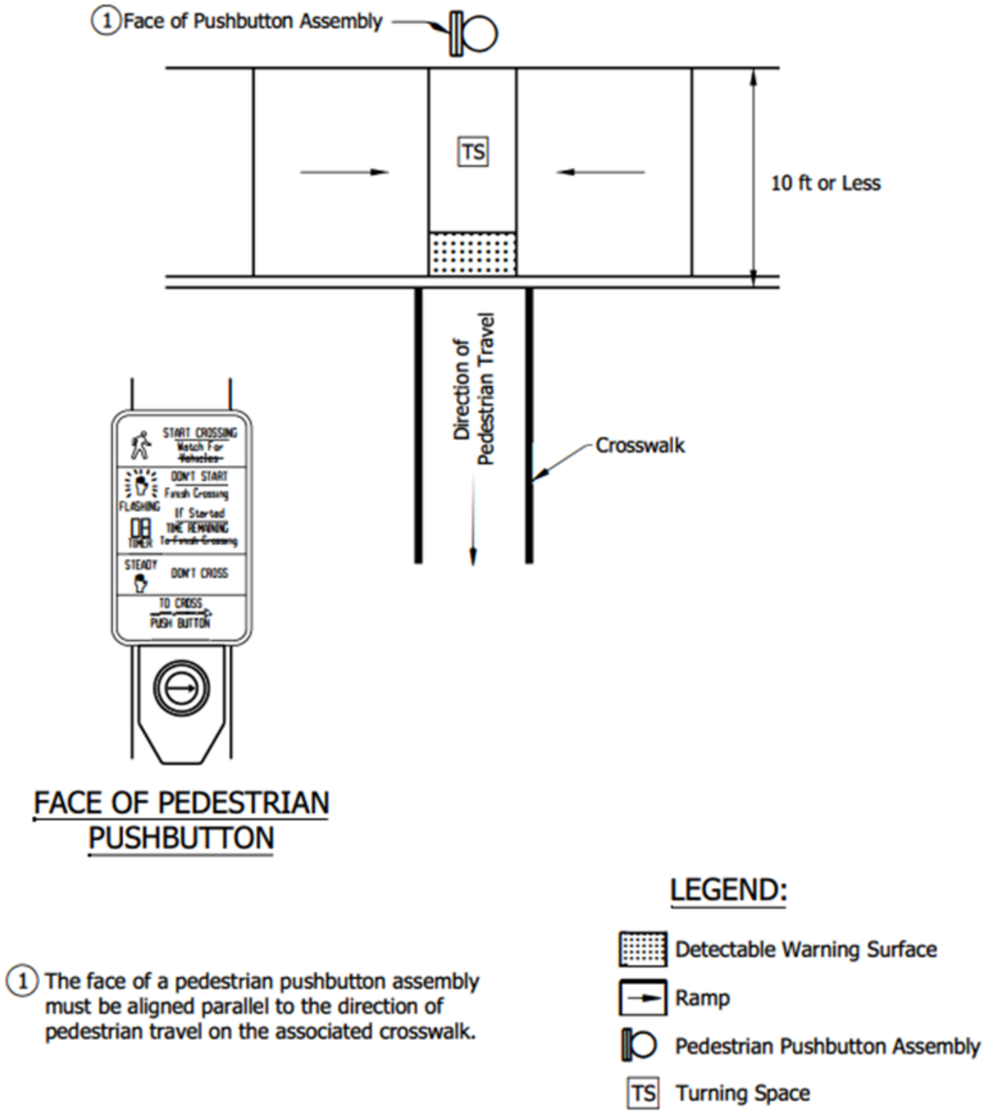
   Minimum dimensions are 4 ft by 4 ft. The pushbutton clear space may overlap a curb ramp turning space. ***Look for obstructions such as curb, slopes, guardrail, or unimproved surfaces that may obstruct access to the pushbutton assembly. Both photos below are examples of non-compliant push button installation.***

Photo: FHWA

5. Actuator. The actuator must be at least 2 in. in diameter with a tactile arrow and contrast with the housing. Fingertip pushbuttons are not acceptable.



6. Orientation of Pushbutton. The face of a pedestrian pushbutton assembly must be aligned parallel to the direction of pedestrian travel on the associated crosswalk or as close as practical.



ORIENTATION OF PEDESTRIAN PUSHBUTTON ASSEMBLY

Section 23:

Paved Side Ditch, Riprap, and Geosynthetics

SECTION 23 – PAVED SIDE DITCH, RIPRAP, AND GEOSYNTHETICS

23.1 PAVED SIDE DITCH

If the grade of a ditch is such that erosion cannot be controlled effectively using sod, paved side ditches may be reviewed for possible installation. Reinforcement is required for all paved side ditches, cut-off walls, and lugs as shown on the plans or Standard Drawings. A strip of sod should be placed along each side of paved side ditch to help prevent the potential for erosion along the edge of the paved side ditch.

If paved side ditch is placed on a steep grade, there is the possibility of surface drainage flowing parallel alongside the side ditch causing erosion and scour under it. When such condition is likely, lugs should be constructed, as shown on the plans, with the upstream edge of the lug lowered so water will be diverted into the paved side ditch.

The spacing of these lugs will depend on the conditions encountered and intervals set out in the Standard Drawings. On steep grades it is necessary to lower the paved side ditch so that the slope from the pavement to the ditch is greater than the grade of the road. In exceptionally rough country, it may also be advisable to use sections of slopewall or riprap to contain the water in the paved side ditch or to direct the water into the paved side ditch at the outlet end of a cross-pipe. A short section of flat bottom paved side ditch, at the outlet end of a cross-pipe, has also been successfully used as a settling basin to direct the cross-pipe water into the V shaped paved side ditch.

Compaction of the soil under the paved side ditch must not be neglected. Without the proper compaction, the ground under the paved side ditch will settle and cause the ditch to break up. Any break in the paved side ditch will allow water to flow under and around the paved section of the ditch and create severe erosion and scour issues.

23.2 RIPRAP

Riprap is specified to help protect slopes or ditches against erosion or scour where vegetation or other methods would be ineffective or impracticable. Future maintenance of ripraped areas should be considered prior to adding large quantities of riprap to a slope. Riprap should never be placed within regulated waterways, unless indicated within the waterway permit.

There are several different types of riprap. The SS and plan documents detail the different types and the material required for their construction. Occasionally, material such as broken concrete or stone may be available from within the contract ROW. These materials could be used for dumped, revetment, class 1, or class 2 riprap. Riprap obtained from within contract ROW will be paid at the contract unit price per square yard.

For riprap to be effective, it should be placed on appropriate geotextile on a stable slope. Careful investigation should be made prior to staking out the proposed riprap area to determine the exact locations where it will be most effective.

When placing riprap within the clear zone of a project, uniform riprap must be used and made as traversable as possible. If a potential for vandalism of the riprap exists, grouted riprap should be considered.

23.3 GEOSYNTHETICS

Geosynthetics may be utilized for many applications including:

- as drainage blankets,
- for pavement, subgrades, or embankments,
- with underdrains,
- under riprap,
- silt fence, or
- as specified.

Geosynthetics shall be placed in accordance with the Geotechnical Report, the contract documents, the SS, and the recommendations of the manufacturer. Geosynthetic material is required to meet the requirements of 918 of the SS for the specific material use. It must be stored appropriately to prevent exposure to direct sunlight and damage from other construction activities. Proofrolling of earth grades and correction of any rutting must occur prior to placement of the geosynthetics. Any damage to geotextiles shall be repaired in accordance with 214 of the SS.

When used as drainage blankets, geosynthetic acts as an encapsulation material for a coarse aggregate drainage layer. Initially and after all wheel rutting has been corrected, the geosynthetic shall be spread taut on the selected area. It shall be overlapped a minimum of 3 ft and sewn in accordance with the manufacturer’s requirements. Coarse aggregate No. 2 or 5 should be placed in accordance with the contract documents or as directed, and then covered and encapsulated using the geotextiles.

When used for pavement, subgrade, or embankment, the geosynthetic shall be spread and held tight. Placement of any further lift, whether coarse aggregate or additional fill, must be placed with minimal disturbance to the grade.

When the plans indicate geosynthetic use with underdrains, the material should be placed loosely, with no wrinkles or folds. Ends shall be overlapped a minimum of 1 ft with the upstream end overlapping the downstream end.

When geosynthetic is used under riprap, the receiving surface shall be prepared to a relatively smooth condition, free from obstructions. Geosynthetics used along channels shall be placed parallel with the channel. Geosynthetics placed on slopes of 2:1 or steeper shall be placed perpendicular to the toe of slope. All overlaps must be installed with the upstream end overlapping the downstream end and the upstream sheet overlapping the downstream sheet. This allows water to flow over the geosynthetic much like water flows over shingles on a roof.

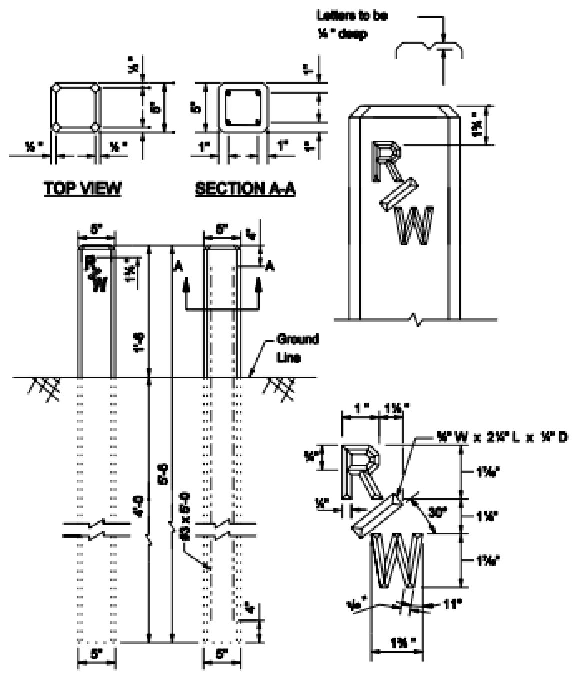
Section 24:

Right-Of-Way Markers and Fence

SECTION 24 – RIGHT-OF-WAY MARKERS AND FENCE

24.1 RIGHT-OF-WAY MARKERS

When new right-of-way markers are indicated on the plans, they must be set in accordance with 615 of the SS. In addition to new right-of-way markers, the plans should also show the number and location of existing markers required to be reset. The Standard Drawings may be referred to for details on new right of way markers as shown below.



Right-of-Way Marker Details

When existing right-of-way markers are required to be reset, care must be used in removing and handling the markers. The markers must be reset in accordance with the Standard Drawings and SS.

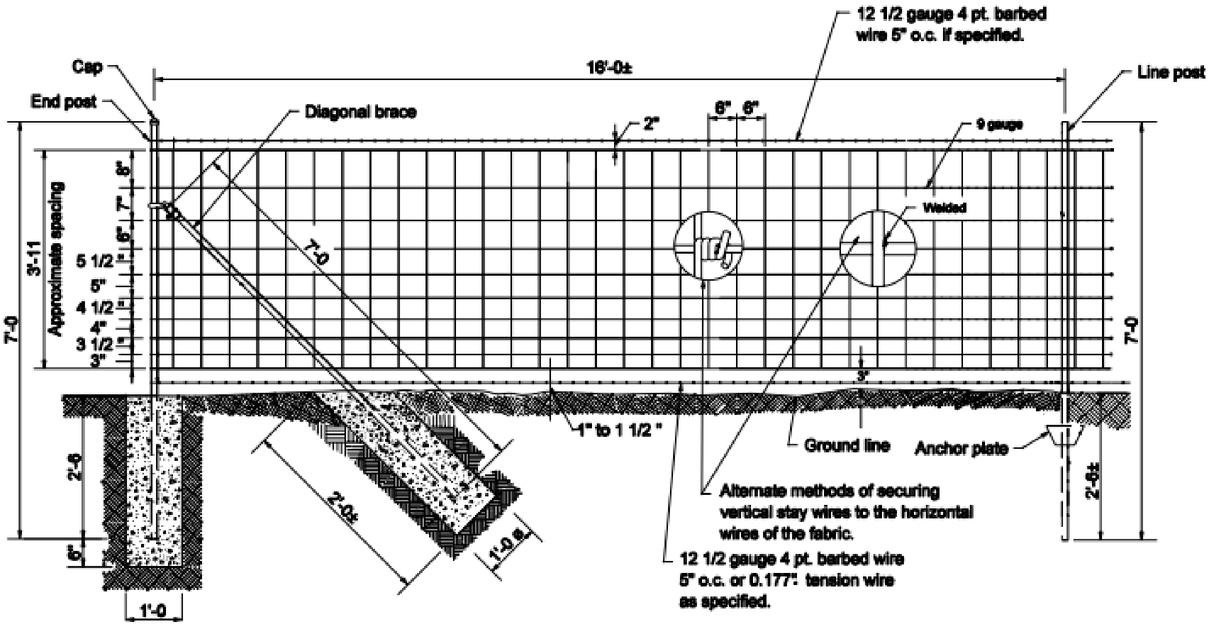
All markers should be set with the rear face of the marker on the right-of-way line and should extend 18 inches above the ground. However, discretion should be used when placing right-of-way markers at the edge of lawns. It may be desirable to set them flush with the ground in those areas.

Right-of-way markers must not be placed where the Department's right-of-way is defined and identified by right-of-way fence. In general, right-of-way markers must define all purchased and unfenced right-of-way or as otherwise noted on the plans.

24.2 RIGHT-OF-WAY FENCE

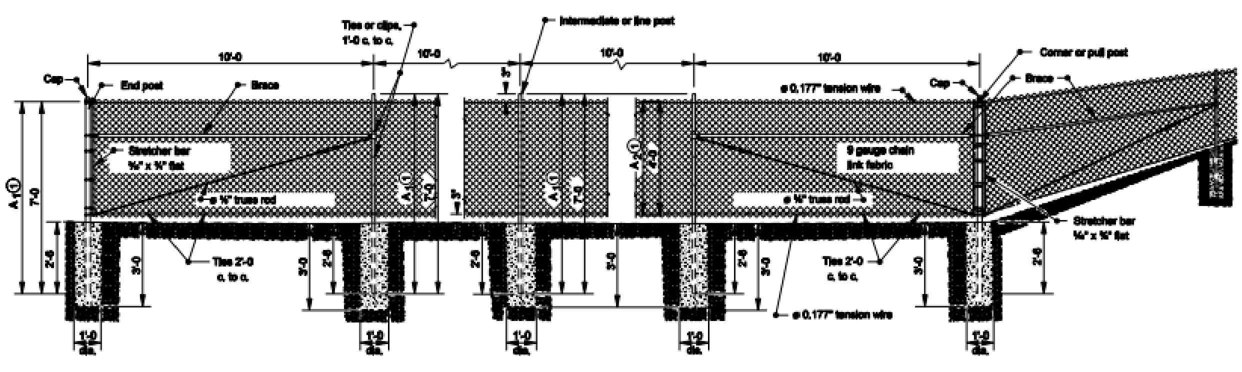
Right-of-way fence is specified on contracts at various locations meeting certain conditions. It is Department policy to place right-of-way fence along limited or controlled access highways for the purpose of preventing access to the highway except at designated locations.

There are two main types of right-of-way fencing. The first type consists of woven wire fabric, otherwise known as farm field fence.



Farm Field Type Fence

The second type is chain link type fence.



Chain Link Type Fence

The type used will be designated in the schedule of pay items as Fence, Farm Field or Fence, Chain Link. The Standard Drawings and the SS cover the details of material and installation for both types as shown in the above figures. In order to construct either type fence to the proper grade and horizontal alignment, clearing and grubbing must be performed.

Unless otherwise directed, posts and their concrete base must be set so the entire fence is inside of the right-of-way. The fence fabric must be placed on the side of the posts nearest to the mainline pavement.

There are locations when it would be advisable to erect the fence on a direct line between two points although the right-of-way may actually project beyond the fence line. An example of this situation might be seen at some corner cuts or sharp breaks in the right-of-way. Where the fence location deviates from the actual right-of-way, keep in mind that the fence must be located entirely on Department right-of-way, and that portion of right-of-way outside of the fence must be identified and marked by placing right-of-way markers at the breaks in the right-of-way.

Gaps in the fence at stream crossings or depressions must be determined in the field. Decisions on whether to gap or span a crossing will depend on the conditions at the site. Always keep the purpose of the fence in mind. If the stream or depression has a depth or span that would preclude entrance onto the right-of-way, a gap in the fence may be the logical solution.

Occasionally, there may be existing fence adjacent to Department fence that is comparable to the fence proposed in the plans This might occur in situations where some industries or institutions parallel their fencing directly adjacent to the right-of-way line. Normally, under such circumstances, best practice is to terminate the Department's fence at the point where the existing fence and the right-of-way coincide, then start planned Department fence again where the existing fence terminates or leaves the right-of-way. In such cases, abut Department fence next to the existing fence but do not fasten Department fence to the existing fence.

The SS and Standard Drawings provide for pull posts to be installed at 500 ft maximum intervals in straight runs, and at each vertical angle point of 10 degrees or more. Corner posts must be set at each horizontal angle point of 10 degrees or more. For any posts that are set in concrete, the concrete must be allowed to cure for 96 hours before materials are allowed to be placed on the posts.

As early as practicable, the PEMS should review the proposed location of the fence with the Contractor to determine the location and extent of all gaps, terminal points, locations necessitating extra length posts, and changes in horizontal and vertical direction affecting material or erection. This review should be in sufficient detail to allow the Contractor to order his fencing material with reasonable accuracy and lead time. The PEMS will measure and pay for the actual quantity placed.

Section 25:

Projects with Local Public Agency Involvement

SECTION 25 – PROJECTS WITH LOCAL PUBLIC AGENCY INVOLVEMENT

25.1 GENERAL

It is the policy of the Department on all contracts located within city limits to contact the local government agency and utilities in writing or in person to explain the impact of the proposed work. These initial contacts are normally made during the design phase. A set of plans is also furnished to the local government agency and utilities.

While it is impractical to locate all underground sewers, utilities, etc. in sufficient detail at the time of the initial survey, all utilities should have been contacted and utility coordination existing condition statements included in the contract documents by the time the final field check is held. The Contractor is still required to contact the utility organizations immediately after the notice to proceed and invite them to attend the pre-construction conference to help determine the final location and elevation of both underground and aerial installations within the contract limits. This information must be obtained to properly coordinate the field layout of the proposed work and to enable the utility organizations to better understand the amount of work that will be required of them.

The PEMS and AE should verify that local officials are contacted after the contract has been awarded to invite them to the pre-construction conference.

Grade lines shown on the plans may often require some slight amount of adjustment. These slight adjustments are typically necessary to meet the urban geometrics involved with sidewalks, intersections, gutters, and to help with the reduction of property damage.

25.2 INTERSECTIONS

Careful study should be given to the grades and drainage requirements at street and alley intersections. In general, when 40 ft wide pavements are constructed in cities, the normal crown should be carried through the intersections in the normal width of pavement. The centerline grade should be carried through intersections where the pavement width is greater than 40 ft and adjustments made in the crown. If not addressed during design, a number of large-scale profiles should be made to help verify the best possible drainage and riding qualities. Grades established for intersections should be inspected and approved by the PEMS before intersection work begins.

25.3 REMOVAL OF LOCALLY OWNED ITEMS

Removal of items owned by a local government agency, such as brick pavements, sidewalks, curb and gutters, castings, and lighting and drainage structures, remain the property of the local government agency if specified in the proposal or on the plans. The local government agency should be consulted before the Contractor removes such items. If they do not desire to salvage them, the removal items will remain the property of the Contractor. Salvaged items will not be allowed to remain within the project limits after the completion of a contract regardless of promises that the items will be removed at a later date. Often the provisions of the contract require removal items to be hauled to a storage yard or to some other designated location.

25.4 CLOSURE OF LOCAL ROADS

The local government agency, as well as the local media, should be kept informed of local road closure times and durations. This will help foster better communications for the contract and provide local officials the opportunity to be more involved and informed in Department operations in their community.

25.5 USE OF LOCAL ROADS

When the determination is made to utilize a local detour as the best option for the official or unofficial detour, arrangements should be made with the local street or highway department to video the existing condition of the proposed detour route prior to the start of construction. Department field staff will record the initial road condition video. Once the use of the detour has concluded, the route should be videoed a second time and compared to the initial video to help determine whether the roads used for the detour route deteriorated with the additional traffic.

Additionally, if a Contractor desires to use local roads as part of their hauling route, they must make arrangements with the local agency to video the haul route and shall take the responsibility for repair of damages. If the roads along the route deteriorate due to the heavy loading brought on by the Contractor's trucks or equipment, the Contractor is obligated to make repairs to the roads at no cost to the Department.

Section 26:

Traffic Management

SECTION 26 – TRAFFIC MANAGEMENT

26.1 [blank]

26.2 LAW ENFORCEMENT OFFICER (LEO)

The information presented herein is in accordance with 23 Code of Federal Regulations 630.1106(a) and Indiana Code 8-23-2-15(b). **RSP 801-R-672** details the use of a Law Enforcement Officer, LEO, as an aid to a contract maintenance of traffic, MOT, plan. The RSP details the requirements for personnel, equipment, and training of a LEO. It also describes the responsibilities of the Contractor, the Engineer, and the LEO to maintain operational consistency from contract to contract.

The use of a LEO on a contract is determined based on the specific needs of the contract for queue protection and speed management. LEOs are a limited resource and should be limited to projects and circumstances where and when the Department determines their presence provides the best effectiveness and value. Not every contract will require a LEO. If it is determined that a LEO would add value to the contract MOT plan, the LEO item should be incorporated into the contract during the design process. A LEO can also be added to an existing contract through the change order process, in accordance with 109.05 of the SS, when the Department authorizes their use. LEOs, as well as all other individuals working under a Department contract, are subject to the requirements of 108.07 of the SS and, as such, may be removed from the contract if their actions or manner is deemed a detriment to the operations. The Department maintains this ability.

26.2.1 Definition

As defined within the RSP and when a LEO is expressly authorized by the Department and present on a contract, they are required to be:

1. off-duty,
2. a non-Indiana State Police Law Enforcement Officer in full police uniform,
3. a graduate of the Indiana approved Law Enforcement Academy, and
4. a police officer or deputy actively employed by a police agency in Indiana.

LEOs are to be placed on contracts to supplement the MOT plan by providing **queue protection, speed management, and patrolling the site**. Any LEO used on a contract through the RSP shall:

1. Be limited to those duties that the police officer normally performs while on active duty; and
2. Do not include the duties of a
    a. Flagman; or
    b. Security Officer.

Indiana State Police, ISP, officers are not considered as LEOs. The use of ISP officers on State contracts is detailed within separate agreements between the Department and ISP. An ISP officer is paid utilizing specific funding appropriated by the legislature for their use on Department contracts. The use of ISP officers is determined through coordination between the Department and ISP. ISP time on Department contracts is estimated prior to the start of the contract and then tracked in the field for payment using the appropriated funds described above.

26.2.2 Purpose

The purpose of the LEO is to provide a law enforcement presence on State and local routes to help increase the traveling public's awareness of queue development and speed management within a construction work zone.

The use of a LEO should be considered when:

1. working on high volume state roads and highways, or local roads and streets,

2. frequent set ups or tear downs of MOT operations within high volume or urbanized traffic locations are occurring,

3. substantial traffic shifts are planned,

4. night work MOT operations suggest queue and speed management problems,

5. multiple lanes of divided highways are planned to be shifted or closed as part of MOT operations,

6. long term lane closures or lane shifts are planned,

7. the first and last days of major changes in traffic control set-ups occur, and

8. observed queue backups or speed management issues have the potential to cause harm to workers or the traveling public.

In most cases, the use of a LEO should not be considered when **interstate** highway queue protection or speed restriction enforcement is being considered. In these situations, ISP is normally called upon to perform interstate queue and speed management.

Exceptions to the above statement occur when LEO officers **with experience in specific high-traffic, high-volume locations** are utilized or are used in support of ISP officers on interstates.

Examples of these specific locations include areas within the Indianapolis metropolitan area including I-465, I-70, I-65, and I-74. Additional locations include interstates I-80/94 and I-65 in northwestern Indiana and I-65 in southern Jefferson County.

There are agreements in place between the Department and local law enforcement agencies within many of these higher volume areas that can be used to help identify and evaluate appropriate LEO involvement on interstates.

An additional exception would occur when a LEO is determined to be utilized as **additional and qualified enforcement support** to ISP officers on interstates for queue protection and speed management.

Questions concerning existing agreements for interstate LEO usage, based on the examples indicated above, should be directed to the Department's Work Zone Safety Section.

26.2.3 Determination of Use

The presence of uniformed police officers in a police agency issued vehicle with red and blue lights provides a benefit as an initial means to slow traffic on approach to a queue. The determination to utilize a LEO should be based upon:

1. The specific potential for traffic queuing:
    a. potential for queuing generally begins with traffic counts;
    b. the counts are processed using the Department's queue modeling tool to determine potential for and length of queue;
    c. the queue modeling tool provides an accurate predictive relationship for relative durations and lengths of queues.

Example: A predicted queue of 4 miles for 8 hours per day will, in most cases, result in lengthy queues even if the actual length might vary slightly from the predicted model. Likewise, short duration or short lengths of predicted queues would typically be a good indication that regular, lengthy queues will not occur.

Queues can be significantly greater than predicted depending on specific actual field conditions such as worker and truck presence within the work zone.

2. Speed management:
    a. reduction of speed prior to and through the work zone,
    b. worker safety, and
    c. traveling public safety.

3. Patrolling:
    a. patrolling through the work zone with lights off may be a necessary aspect of the Leo's shift, and
    b. patrolling through the site helps the traveling public identify that there is the potential for citations and tickets to be issued within the work zone for infractions.

26.2.4 Field Conditions

A LEO may still be considered when traffic counts and modeling would not initially indicate the necessity.

LEO usage is an important tool, but should not take the place of properly utilized MOT devices as described in the Indiana MUTCD.

When actual field conditions influence design developed traffic count modeling, the choice to use a LEO will require Department field staff, including the PEMS, AE, and the DCD, to determine if the addition and utilization of LEOs on the contract would be an effective use of resources. If field observations indicate the need for a LEO, based on unacceptable queuing situations or for speed management, the determination to add a LEO should be reviewed and discussed with the contract MOT team including the Contractor and Designer.

The use of a LEO should be considered for queue and speed management situations involving:

1. state roads and highways; and
2. local street and roadway contracts.

There are contract queue protection and speed management situations in which the use of a LEO would be advantageous for local contracts when posted speeds are 45 mph or less. Situations where the use of a LEO for local streets and roadways should be considered include:

1. high volume or congested streets and roadways,
2. narrowing of lanes in urban locations,
3. temporary closure of lanes,
4. lane-by-lane local bridge rehabilitation,
5. reduction of speeds through a local work zone, and
6. when there is observed queue backups or speed management issues that have the potential to cause harm to workers or the traveling public.

As with other work zone contract choices, the determination to utilize a LEO on a local contract should be discussed with the MOT team.

Additional aspects to consider when evaluating the use of a LEO include the extent of worker exposure to high-speed traffic and the observance of excessive speeds in advance of and within the work zone. In these cases, the utilization of a LEO for speed management would be an advantage for both worker and traveling public safety.

Existing implementation of other traffic control features may also affect the need and use of a LEO. Modification of or the use of these features may curtail or eliminate the need for a LEO. These features include:

1. the use and location of existing signage,
2. barrier wall,
3. arrow boards,
4. changeable message signs,
5. temporary worksite speed display assemblies,
6. truck mounted attenuators.

26.2.5 Discussion Topics

Topics of discussion prior to the addition of a LEO on a contract should include:

1. the intended message of the MOT plan and the perception of the plan by the traveling public,
2. the availability of traffic counts to help determine queue predictions,
3. the improved message of the overall intent of the MOT plan with the addition of a LEO, and
4. the most advantageous times and placement of the LEO to achieve the best overall desired outcome for queue protection and speed management.

26.2.6 Implementation

The requirements within these instructions and RSP 801-R-672 are to be followed for LEO implementation on any contract. **A contract must include RSP 801-R-672 to utilize a LEO**. If the contract does not contain the RSP, the Contractor must obtain a zero dollar change order to include the RSP on the contract prior to utilizing the LEO for the contract. Additionally, the following must be observed:

1. LEOs procured directly from a government agency or local entity do not require a subcontract.
2. If a LEO is provided by a private company, the Contractor must execute a Department approved subcontract for the private company prior to utilizing the LEO on the contract.
3. Any potential DBE, MBE, WBE, or IVBE credit for LEO usage will be available only to a certified DBE, MBE, WBE, or IVBE company.
4. LEO services are limited to the activities described within RSP 801-R-672 and IC 8-23-2-15(b).

   Individuals offering or performing services outside of these requirements are not considered LEOs, must not perform the duties of a LEO, and are not to be paid as a LEO.

26.2.7 Responsibility and Coordination

The responsibilities of and coordination between the Contractor, the Engineer, and the LEO are outlined within the RSP. The Contractor will be responsible for the activities of the LEO while they are performing contract specific duties. The Engineer has the responsibility to maintain, direct, or modify the Contractor assigned activities of the LEO based on the operational need and safety of the contract and the traveling public. The LEO should be relocated, as necessary, to enable queue protection and speed management. The LEO must remain effective and aid in the conveyance of the intended requirements of the overall contract MOT plan after any relocation directed by the Department.

1. LEO

The LEO has the responsibility to:

a. report to the Contractor at the start and end of their designated shift. The Contractor is responsible to provide, with the approval of the Engineer, instruction to the LEO for work assignments at the start of each shift,

b. remain at the contract site for the duration of their shift, and

c. perform other duties, as assigned, to help enforce speed reduction through the site when their original assigned duties have been completed.

2. Contractor

The Contractor has the responsibility to:

a. secure the services of a LEO and communicate the intentions for use of the position with the selected officer,

b. assign the duties and placement of the LEO. **The choice of duties and the placement of the LEO are subject to approval of the Engineer**,

c. inform the Engineer of the start and completion of the LEO shift, and

d. ensure that the LEO remains on-site for the duration of the approved shift and inform the Engineer of problems or concerns arising from the placement or effectiveness of the LEO.

3. Engineer

The Engineer retains authority over all contract activities. If the placement of any MOT device or service is deemed inappropriate or detrimental to the overall MOT plan, the Engineer has the authority to:

a. direct changes and modify the MOT to provide a safer work zone condition,

b. maintain authority over the Contractor's assigned duties and placement of any LEO,

c. confirm the LEO is performing their appropriate duties according to their placement on the contract. Even though the Contractor is to direct the duties and placement of LEOs, those instructions are subject to the authority and direction of the Engineer while the LEO is associated with the contract, and

d. direct the LEO to perform enforcement and other related duties to help encourage the traveling public to "respect the work zone".

All LEOs are to follow established procedures, in accordance with Indiana Code 9-21-5-11, for infraction and ordinance violation enforcement while working the construction site. LEOs are encouraged to pursue motorists **only** when the actions of those motorist are considered reckless and endanger the workers or traveling public at the site. They should also provide response to incidents that involves public safety near or within the limits of the contract.

The placement of a LEO behind barrier wall is not an effective use of this limited resource service.

26.2.8 Training

Prior to the placement of the LEO on site, training must be completed. Associated training for LEO operations consists of two parts. The first training portion consists of completing the Department's web-based training course. The second portion consists of completing the Department's supplementary guidance on LEOs working within construction zones.

1. Part 1 - Training

Prior to involvement in maintenance of traffic operations, the LEO, at least one representative of the Contractor who will be on-site when the LEO is present, and the Engineer must complete the Department's web based "Law Enforcement Officers in INDOT Work Zones Training Video (Part 1)". The course is described within the RSP and can be accessed through the Department's Law Enforcement Officers for Work Zone Safety website at:
https://www.in.gov/indot/safety/work-zone-safety/law-enforcement-officers-for-work-zone-safety/

2. Part 2 - Training

The LEO, the Contractor, and the Engineer are also required to review, discuss, and agree to adhere to the requirements contained in the Department specific training entitled "Instructions For Non-ISP Law Enforcement Officers When Working in INDOT Work Zones (Part 2)". The training document can be accessed through the Department's Law Enforcement Officers for Work Zone Safety website at:
https://www.in.gov/indot/safety/work-zone-safety/law-enforcement-officers-for-work-zone-safety/

Participants completing Parts 1 and 2 training must sign and date the Participant Affirmation page at the end of the Part 2 training document. By signing, the individuals are confirming they have completed Parts 1 and 2 of the law enforcement training requirements. The PEMS must sign and date the Verification Statement at the end of the training document. The training document, all notes, and the signature information are to be retained within the contract files.

26.2.9 Payment

1. Approved Shift Hours

Payment for the use of a LEO is governed by the process outlined within the RSP. The LEO is paid based on an hourly rate for their service. Payment is only provided for LEOs approved for use on the contract by the Department. Payable hours are determined based on the number of approved shift hours that the LEO is utilized for MOT operations. Each portion of an hour required will be measured as a whole hour. Example: If a LEO is required and works for 3 1/4 hours, they will be paid for 4 hours.

2. Training

Training costs will not be measured for payment. Contractors are to include any training costs in the cost of the other items of the contract.

26.3 OVERHEAD SIGN STRUCTURES

Loose anchor bolt hardware or hardware out of position is a common issue found during inspection of overhead sign structures. Many times, hardware may be properly re-tightened by the Contractor. Care must be taken when applying any re-tightening force to prevent seized anchor bolts from cracking or stripping.

Out of position anchor bolts are found not only on older structures but also on new installations. They can lead to premature fatigue and structures being removed from service. The PEMS must verify Contractors are following best practices in accordance with 802.07(b) of the SS. Best practices include tightening the nuts by following the “star pattern” order as indicated within Standard Drawing E 802-SBTS-17. Additionally, for truss structures, the hardware should be checked and re-tightened as needed after the truss has been set in place.

26.4 GROUND MOUNTED PANEL SIGN SUPPORTS

The W-beam structural steel supports for ground mounted panel signs are designed to meet the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. As detailed in the SS and Standard Drawings, they are also compliant with FHWA’s eligibility requirements for roadside hardware.

Proper installation is necessary for supports to withstand the design wind loadings and to breakaway during a vehicular impact so the occupants within the vehicle have a significantly reduced chance of being seriously injured or killed.

Particular attention should be paid to the following:

1. There should be no perceivable gap between the upper and middle beam sections at the fuse/hinge plate – the allowable tolerance for this fit is 0 to 1/16 in. The fuse plate/hinge plate attachment hardware should be fully tightened in accordance with the SS and Standard Drawings. Excessive gaps and loose hardware result in premature fatigue in the fuse plates which can result in structural failures. The fuse plates are intentionally weakened via the perforated holes. This feature facilitates breakaway performance during impact. Refer to Standard Drawing E 802-SNGP-05 for fuse plate details.
2. The perforated fuse plate must be installed on the front (traffic approach) side of the sign and the hinge plate on the back side for the supports. Refer to Standard Drawing E 802-SNGP-05 for plate connection details.
3. The hardware at the base plate must be properly tightened within the range provided in the SS and the Standard Drawings. The specified torque values are sufficient so that the structure should not "walk-off" the base and foundation but not so great as to prevent the breakaway slip mechanism from engaging when the structure is impacted.
4. The beams must extend through the entire height of the sign. Refer to Standard Drawing E 802-SNGP-02 for beam placement.

Properly installed sign clips allow an even distribution of the forces transmitted from the sign to the beams improving the service life of the structure. Refer to 802.08(b) of the SS and the Standard Drawings.

26.5 LIGHTING LEVELS

Illumination levels, the amount of light that reaches the pavement, and the Correlated Color Temperature (CCT) can be verified after installation by use of a Chroma meter. The Traffic Administration Office has this equipment and should be contacted to discuss the necessity of this test.

26.6 PAVEMENT MARKINGS

26.6.1 Placement Considerations

Permanent pavement markings are one of the last items to be installed on most contracts. They are usually installed in the later part of the year, when temperatures begin to fall. It is important to monitor temperature and pavement surface conditions in advance of permanent pavement marking placement. Temporary markings may be required until weather conditions improve. The potential for contract time extensions for pavement marking issues should be discussed with the AE.

The PEMS should also remember that pavement surfaces must be visibly dry, in accordance with the SS, for any marking material to be successfully applied. The Contractor may also need to perform a pavement moisture test (ASTM D1461) to verify.

Permanent markings are required to follow the widths indicated within the SS and contract plans. Normally, center lines, lane lines, and edge lines should be 6 in. wide for state highways and 4 in. on all other roads.

26.6.2 Durable Markings

Substitution of durable markings for other pavement marking materials should only be performed after consultation with the DTE. The DTE should be consulted before a change of marking material is accepted.

Alternatives that may be substituted for durable markings in late season, cold weather conditions include, but are not limited to, polyurea, methyl methacrylate (MMA), low temperature waterborne paint, cold weather thermoplastic. Price adjustments, either up (polyurea or MMA) or down (paint), may be required with any substitute material. Reference should be made to the SS for low temperature limits for permanent pavement markings. The DTE may also be contacted for additional questions and concerns.

Consideration may also be given to installing temporary markings (paint, type I tape, 40 mil thermoplastic) and postponing the installation of the permanent markings until weather conditions are more acceptable.

26.6.3 Groove Depth and Wet Reflective Elements

In accordance with the SS, all durable markings placed for center lines, lane lines, or edge lines are installed in a groove milled into the pavement surface. This process helps protect the Department's investment by significantly reducing the possibility of the durable marking receiving damage due to snow plowing. It is necessary to mill the groove deep enough to completely recess the marking material. The groove should not be milled too deep and prevent the wet reflective elements from performing as intended. Water depth over the wet reflective elements alters how light is reflected off the marking. This change in reflection does not allow the markings to be seen properly by the driver and greatly reduces their effectiveness. The Contractor must utilize installation crews properly trained in milling the grooves for wet reflective markings. In accordance with the SS, the maximum allowable depth for grooving is 150 mils (slightly under 5/32 of an inch). Diamond gang saw blades are recommended for the grooving operation to achieve the proper width and depth in a single pass.

Where pavement markings are grooved, in accordance with the SS, the minimum cure time for joint sealant is not applicable.

26.6.4 Pavement Corrugations, Rumble Strips, and Rumble Stripes

On roadways other than interstates, a 20 ft gap for every 80 ft of shoulder corrugation or edge line rumble stripe must be provided. PCCP roadway shoulders are required to have four continuous pavement panels with corrugations followed by one panel without. Refer to the Standard Drawings for Pavement Corrugations, Rumble Strips, and Rumble Stripes. The Standard Drawings indicate additional gap requirements for shoulder corrugations and edge line rumble strips at turn lanes, intersections, railroads, and bridge decks. Errors in the installation of shoulder corrugations and edge line rumble strips are difficult to correct and often involve replacing or adding pavement.

Pavement corrugations, when used for center line rumble stripes, must be gapped for raised pavement markers. Normally, raised pavement markers will be placed after pavement corrugations have been installed. The PEMS must verify the gaps for raised pavement markings are laid out before installing the center line rumble stripe.

26.7 AS-BUILT DRAWING SUBMITTALS

Within 30 calendar days after completion of the work, the Contractor is required to submit as-built drawings, in electronic format, to the Engineer. Signal as-built drawings must indicate the as-built location of steel strain poles, signal cantilevers, service points, controller cabinet, loop detectors, conduit runs, and signal handholes. Lighting as-built drawings are required to indicate the as-built location of light poles, high mast towers, service points, conduit runs, and lighting handholes.

26.8 HIGH FRICTION SURFACE TREATMENTS *(add. 12-01-25)*

High friction surface treatment, HFST, is used on either asphalt or concrete pavement surfaces to enhance skid resistance. The higher pavement friction helps motorists maintain better control in both dry and wet driving conditions, to reduce roadway departure crashes and improve safety. It is produced using a calcined bauxite aggregate bound with a polymeric resin.

The Contractor is required to submit a QCP to the PEMS 14 days prior to the HFST application. The QCP is subject to acceptance by the PEMS. The QCP is required to indicate the proposed methods to control the equipment, materials, mixing, and paving operations to ensure conformance with the requirements within RSP 617-T-213. Certifications for the materials are described within the RSP.

The HFST is required to be applied utilizing a truck mounted application machine. The equipment must be capable of applying the binder and aggregate at a minimum continuous rate of 2,300 sq yd/hr. Polymer mixing and distribution equipment and aggregate distribution equipment must comply with the requirements of RSP 617-T-213.

The HFST materials are not to be placed when rain is forecast during the material application or curing. No moisture should be present on the surface of the pavement at the time of application. A plastic sheet, 18 in. by 18 in. taped in place for a minimum of two hours and up to sixteen hours, in accordance with ASTM D4263, is used to identify moisture on the pavement. An electrical impedance meter that meets ASTM F2659 may also be used to check surface moisture. A test section, described in RSP 617-T-213, is required to be constructed within the contract to demonstrate the truck mounted application machine has been properly calibrated.

After the pre-construction conference, the PEMS must notify the Department's Research and Development section of the project schedule and provide contact info for the Contractor so that friction testing can be conducted within the testing window, described within RSP 617-T-213, after installation.

If the Department's Research and Development section is unable to perform the friction testing or where there is a particular concern about delamination at one or more locations on the project, mean profile depth testing should be conducted to complete the acceptance testing.

<u>Section 27:</u>

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Section 28:

Field Documentation

SECTION 28 – FIELD DOCUMENTATION

28.1 GENERAL

The use of electronic data collection systems is encouraged and acceptable. These systems will become more prevalent in the future. As new processes are developed, electronic data information will become a dominant factor for documentation.

28.2 ORIGINAL FIELD MEASUREMENTS

The Department has established the following procedures for documenting original field measurements for AWP contracts.

1. Field measurements for payment should be recorded electronically in the field at the time of measurement in a format suitable for inclusion as a permanent part of the contract's documentation. Standard Department electronic forms should be utilized when appropriate to record field measurements for specific items. Documentation generated and stored outside of AWP should utilize the Intelligent File Cabinet system. This system provides a consistent and uniform process for storing documents for the contract.
2. Documentation stored within AWP should be entered into the system directly from original field measurements. When the Field Assistant application is utilized, original field measurements for payment should be recorded at the time of measurement and synced to the system, when appropriate. Field notes should be digitized and stored within the Intelligent Filing Cabinet system for retention.
3. When pay quantities are estimated during the contract prior to final field measurement, the use of Inspector's Dailies or other documentation, not part of the FCR, is acceptable for making entries. As items of work are completed and final field measurements are made and documented as described above, the estimated pay quantity for an item should be adjusted in AWP as needed to correlate to the final pay quantity. A note in the comments section of AWP should be made to describe why the adjustment was made.
4. Original field measurement documents are necessary to justify the payment of items. Documents should be organized and stored within the Intelligent File Cabinet system. Documents necessary for the FCR submittal must be stored within the Intelligent FCR system.

The procedures outlined above are intended to compliment other instructions within the GIFE and the Final Construction Record Guide, not to replace them.

Questions concerning documentation of original field measurements should be addressed to the District Construction Records Officer. District Construction Records questions should be addressed to CM.

28.3 AWP DATA ENTRY

The purpose of these instructions is to establish standardized guidelines for the entry of data into AWP to promote greater efficiency. All current policies and procedures should continue to be followed unless revised by the following instructions.

28.3.1 Personal Data Entry

All data collected by a Construction field employee will be entered into AWP by the employee collecting the data. This allows supervisors the ability to authorize information as intended. Under no circumstances will an employee log in or enter data into AWP using a login ID other than their own, as indicated in the Information Resources Use Agreement. An employee's manager will not enter information into AWP unless one of the following exceptions occurs:

1. A specific individual has been assigned to complete all paperwork for a contract as identified by the corresponding AE or DCD.
2. An employee's absence from work is preventing payment to the Contractor.

28.3.2 Data Entry Timeframes

This procedure ensures that information is entered in a timely manner and that estimates for contractor payment will not be delayed.

Daily Work Reports

All information regarding Contractor activity, personnel, equipment, and pay items will be entered into a Daily Work Report in AWP by the PEMS or HT who observed the work. The information should be entered within two business days of completion, excluding weekend days and State holidays.

Material Sample Information

All information pertaining to materials delivered to the site should be entered into the Sample Record in AWP. If the sample contains test results, it should be entered by the PEMS or HT who performed the test. The information must be entered within two business days, excluding weekends and State holidays.

HMA and soil samples taken to area labs or District labs MUST be entered into AWP before the sample is transported. If the sample is for a certification, CAPP, or Material List Approval Number, it may be entered by any individual on site and should be completed within ten business days of the material being installed, excluding weekends and State holidays. Exceptions to this timeframe include tests that require more than a ten business day waiting period before testing is completed, according to the SS or Frequency Manual. This ensures that information is entered in a timely manner and expedites the Material Certification process.

Section 29:

Shop Drawings, Falsework Plans, and MSE Wall Design

SECTION 29 – SHOP DRAWINGS, FALSEWORK PLANS, AND MSE WALL DESIGN

29.1 GENERAL

To make the review process more efficient, the Department encourages the Contractor to submit electronic copies of shop drawings and design calculations for approval in lieu of printed copies. Every submittal must include the contract number, Contractor's name, and the contact person with their contact information. All drawings and calculations must be submitted in the units used for the contract. Regardless of the submittal process described below, Contractors shall communicate directly with the PEMS to keep them informed of the status of submittals.

29.2 SHOP DRAWING AND FALSEWORK PLAN REVIEW *(rev. 12-01-25)*

29.2.1 LPA Contracts

For LPA contracts, the review of all shop drawings and other items listed in 29.2.3 of these instructions are the responsibility of the LPA or their designated representative. Contractors on LPA projects are to submit shop drawings and falsework plans as directed by the LPA. Questions about LPA procedures are to be directed to the District Local Projects Administrator.

a. **Structural Members and Items**

Shop drawings for structural members and components are to be submitted to the LPA or their designated representative for review and approval. Since the Department is responsible for fabrication inspection of structural members, upon completion of the shop drawing review, the LPA or their representative must forward an electronic copy of the approved shop drawings to the Department's Bridge Design section, at BridgeDesignOffice@indot.IN.gov.

b. **Approval of Pile and Driving Equipment**

The Contractor shall submit to the LPA or designated representative, a completed pile and driving equipment data form IC-740 at least 15 calendar days prior to driving piles. The EOR shall review the IC-740 form for acceptance. The IC-740 form is available on the Department's website at: https://erms12c.indot.in.gov/fcrdocuments/. The Contractor will be notified by the LPA or designated representative, of the acceptance of the proposed pile driving system within 15 calendar days of the receipt of the IC-740. Acceptance of pile and driving equipment does not relieve the Contractor of the responsibility to provide equipment suitable for driving the specified piling to the required bearing without damage. The LPA or designated representative shall notify GS, at geotech@indot.in.gov, and the PEMS of the acceptance of the proposed pile driving system.

29.2.2 Design-Build Contracts

Responsibilities and procedures for shop drawing review and approval are typically described in the design-build contract documents. If not described, the procedures or portions described in 29.2.3 of these instructions are to be followed.

Structural Members and Components

Once the shop drawings for structural members and components are approved by the responsible party designated in the contract documents, the Contractor must submit the drawings directly to Burgess & Niple, Inc. at shopplanreview@burgessniple.com for contract document management and archival within ERMS.

Depending on the design-build contract documents, either the Department or the Contractor will be responsible for fabrication inspection of structural members and components. If inspection is the responsibility of the Department, the Contractor must email StructuralMemberQAInspection@indot.in.gov prior to shop drawing approval. This will ensure inspection services are coordinated and available, as fabrication cannot begin without them.

29.2.3 State Contracts

The following procedures have been implemented for submittal and review of shop drawings, falsework plans, and related items as described below. If the DO has any concerns about the structural integrity of any shop drawings submitted with a professional engineer's stamp, they should contact their CM FE for further assistance.

a. Structural Members and Items

Shop drawings for the following items are to be submitted by the fabricator or supplier directly to Burgess & Niple, Inc. for review and approval. Shop drawings must be in accordance with the applicable specifications. These items do not require a professional engineer's stamp for submittal. Any Request for Information (RFI) correspondence between the fabricator/supplier and EOR that occurred post bid must be submitted with the shop drawings.

- Structural steel and structural concrete members
- Modular expansion joints
- S-S joints
- Elastomeric bearings.

Shop drawings must include the following:

- Contract number with prefix
- DES/Project number and lead DES number
- Bridge file number
- County
- State
- Location description.

Shop drawings are to be sent to Burgess & Niple at shopplanreview@burgessniple.com. Their office phone number is (317) 237-2760. Burgess & Niple will send approved shop drawings to the Department's Bridge Design section at: BridgeDesignOffice@indot.IN.gov for distribution to the District Construction office.

b. Mechanically Stabilized Earth (MSE) Retaining Walls

Shop drawings and design calculations for MSE retaining walls must be stamped by a professional engineer and submitted by the Contractor electronically to GS at MSEWallShopDrawings@indot.in.gov and the EOR for review and approval. The contract number shall be part of the subject line.

The EOR, as part of review, must complete the MSE Wall Shop Drawing Review Checklist. An editable copy of the MSE Wall Shop Drawing Review Checklist is available from the Department's Editable Documents webpage, under Geotechnical.

The EOR will attach a cover letter and send a copy of approved shop drawings to the Contractor/submitter and to the District Construction office for further distribution.

c. Post Tensioning Systems

Shop drawings and design calculations are to be submitted by the Contractor for all post tensioned structural members and components. Shop drawings and design calculations must be stamped by a professional engineer and submitted to the PEMS by the Contractor. The PEMS will send the shop drawings and calculations directly to the EOR for review and approval and copy the Bridge Design section at BridgeDesignOffice@indot.IN.gov. The EOR will send approved shop drawings to the PEMS for distribution to the Contractor. Copy the Bridge Design section on the approval.

d. Sound Barrier Systems

Shop drawings and calculations for sound barrier systems are submitted by the Contractor or fabricator directly to the EOR for review and approval. The plans and calculations must be stamped by a professional engineer. The designer will attach a cover letter and send a copy of approved plans and calculations to the submitter and to the District Construction office for further distribution.

e. Precast Concrete Three-Sided Structures and Box Culverts

Shop drawings and design calculations must be in accordance with the applicable SS for three-sided and box structures.

Shop drawings and design calculations must be stamped by a professional engineer. Shop drawings for three-sided structures must include details to provide sufficient horizontal restraint (prior to backfill being placed) unless the design demonstrates such restraint is not required.

Plans and calculations are to be submitted by the Contractor to the PEMS. The PEMS will send the shop drawings directly to the EOR for review and approval. The EOR will send approved shop drawings to the PEMS for distribution to the Contractor.

For structures requiring load rating, the Contractor must copy the EOR on the submittal to the PEMS. The EOR must also submit a New Design request in the Load Rating Request Application (LRRA) through ITAP. The EOR must upload the shop drawings, load rating calculations, and load rating summary (*see* RPD 700-B-301d) with the New Design LRRA request. An automated email notification will be sent from LRRA to the EOR when the load rating review has been completed. If the EOR's review requires revisions to the shop drawings that affect the load rating, a resubmittal within LRRA is required.

f. Welded Wire Reinforcement

Shop drawings must be stamped by a professional engineer. Shop drawings and design calculations are to be submitted to the PEMS for locations where the Contractor proposes to substitute welded wire reinforcement in lieu of the reinforcing bars shown on the plans.

The PEMS must send the drawings and calculations directly to the EOR for review and approval and copy the Bridge Design section at BridgeDesignOffice@indot.IN.gov. The EOR will send approved shop drawings to the PEMS for distribution to the Contractor.

g. Traffic Items

Shop drawings for signing, signals, and lighting will be reviewed and approved by the Department's Traffic Design and Review Group. These items typically include all overhead sign structures, signal strain poles and cantilevers, high mast lighting, luminaries, and light poles. Plans and calculations must be submitted by the Contractor to the PEMS and forwarded to the Traffic Design Manager at TrafficDesignReview@indot.IN.gov for review and approval.

The Traffic Design Manager will distribute approved shop drawings to the PEMS for distribution to the Contractor.

h. Falsework and Cofferdam Drawings

Falsework plans for the following items are to be submitted to the PEMS. Each sheet must include the contract number, Contractor's name and must be stamped by a professional engineer.

- Cofferdams and Dikes
- Deck Falsework - temporary
- Coping falsework
- Falsework for reinforced concrete slab superstructures
- Falsework for hammerhead pier caps.

The PEMS will review drawings for compliance with the specifications and the specific job conditions only. Questions should be directed through the AE and District Construction office.

i. Temporary Bridges

Load rating is required for temporary bridges to ensure safety under live traffic loadings and accurate structural evaluation for oversize-overweight (OSOW) vehicle permits while the bridge is in use. For temporary bridges and other temporary structures open with total spans greater than or equal to 20 ft that will be open to traffic, the Contractor must submit a shop drawing package to the PEMS and the EOR that includes the following:

- Maintenance of Traffic plans
- Initial traffic phasing schedule
- Stamped Temporary Bridge shop drawings
- Stamped design calculations.

Once the EOR has reviewed the submittal and taken no exceptions, the EOR must forward the submittal to INDOT Load Rating at LoadRating@indot.IN.gov. All initial recipients should be included in the notification. Within 30 working days of notification, INDOT Load Rating will reply with final ratings. The PEMS will update INDOT Load Rating on exact dates for when the temporary bridge will be open to traffic and phase changes. To align with OSOW permit approval windows, these updates need to be made 14 calendar days ahead of each traffic change in the field. The PEMS, or other delegated district representative, will also update CARS entries as traffic phasing changes.

j. Permanent Metal Deck Forms

Shop drawings submitted by the Contractor must be stamped by a professional engineer. Shop drawings for permanent metal deck forms are to be submitted by the Contractor to the PEMS for review for compliance with the SS and the specific job conditions only. CM maintains a deck form calculation spreadsheet that can assist in review of metal deck forms if concerns arise. Reference can be made to Section 5.9 of these instructions.

k. Foundation Seals and Deck Pour Sequences

Requests for use of foundation seals not shown on the plans are to be submitted to GS at geotech@indot.in.gov for review and approval. The submittal must include the contract number, Contractor's name and indicate the location and dimensions of the seal. GS will distribute approved requests.

Planned deck pour sequences are to be submitted by the Contractor to the PEMS. The PEMS must send the deck pour sequence directly to the EOR for review and approval and copy the Bridge Design section at BridgeDesignOffice@indot.IN.gov. The EOR will send approved shop drawings to the PEMS for distribution to the Contractor.

l. Approval of Pile and Driving Equipment

The Contractor shall submit a completed electronic pile and driving equipment data form (IC-740) at least 15 calendar days prior to driving piles to GS. A copy shall also be furnished to the PEMS. The IC-740 form is available on the Department's website at https://erms12c.indot.in.gov/fcrdocuments/. The Contractor will be notified of the acceptance of the proposed pile driving system within 15 calendar days of the receipt of the IC-740 form. Acceptance of pile and driving equipment does not relieve the Contractor of the responsibility to provide equipment suitable for driving the specified piling to the required bearing without damage.

m. Temporary Causeways (timber mat bridge, culverts)

Proposals for stream crossings, causeways, and work bridges for construction traffic are to be submitted to the PEMS, prior to construction, as part of the SWQCP or written site plan developed by the Contractor. The proposals will be reviewed and will be eligible for acceptance if found to be in compliance with the requirements of the Department's Design SWP3, the CSGP, and all applicable waterway permits. If the proposal varies from any of the contract's waterway permit conditions, the Contractor is required to submit a permit modification request to the PEMS. The request must include:

- The scope of the proposed changes to the permit
- The reason for the added impacts any avoidance or minimization that has been considered
- Contract plans marked with the location of all proposed changes.

Accepted modification requests will be forwarded to the appropriate regulatory agency by the Department's Office of Ecology, Waterway Permits, and Stormwater.

Work on the revised causeway details is not to progress until the approved permit modification request has been received and posted at the worksite.

n. Retaining Walls

Shop drawings and design calculations are to be submitted by the Contractor for all structural retaining walls and components including cast in place, precast concrete tee or bin walls, modular block, cut wall, and temporary wire faced MSE wall. Shop drawings and design calculations must be stamped by a professional engineer. Shop drawings and calculations are to be submitted by the Contractor to the PEMS. The PEMS must send the shop drawings and calculations directly to the EOR for review and approval and copy the Bridge Design section at BridgeDesignOffice@indot.IN.gov. The EOR will send approved shop drawings to the PEMS for distribution to the Contractor.

o. Miscellaneous

Shop drawing and design calculation submittals for miscellaneous items not covered by the above sections must be submitted thru the PEMS. The PEMS should work thru the District Construction office and CM to determine the approval process for these items.

29.3 MECHANICALLY REINFORCED EARTH (MSE) WALL INSTALLATION

29.3.1 Design Components

Internal, external, and compound stability design components are the responsibility of the Contractor. The Contractor shall submit working drawings and design calculations. The design factors used shall be current and acceptable to the Department. The design will be approved prior to the construction of the wall in accordance with 29.2.3 of these instructions. Questions on wall design information, including working drawings and design calculations should be directed to the EOR and to GS.

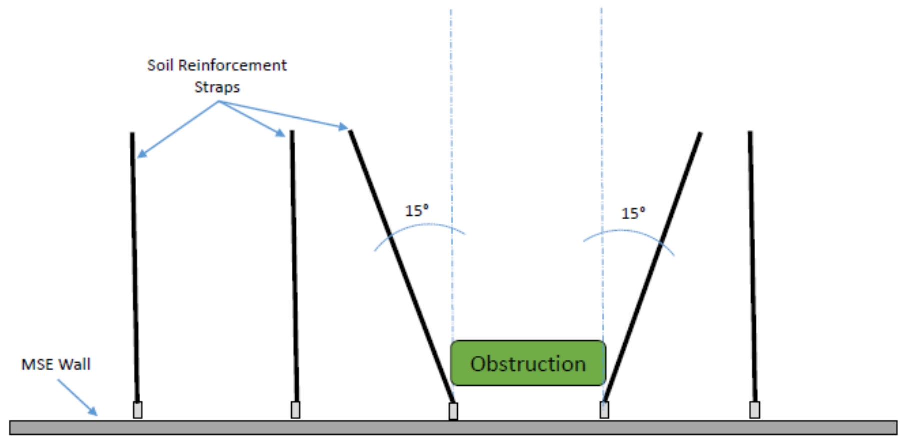
The top of the leveling pad elevation is required to be a minimum of 1.0 ft above the ordinary high water mark, OHWM, or groundwater table elevation, whichever is higher. The leveling pad dimensions are required to be 12 in. wide and 6 in. thick and shown on the shop drawings.

29.3.2 Reinforcing Straps

Reinforcement straps are required to be straight and level when placed. There should not be vertical gaps between the wall connection and the end of the ground reinforcement strap. Straps must be the correct length for the location.

Contractor supplied shop drawings and working drawings are required to be checked for information concerning the ground reinforcement strap location, type, and length. Ground reinforcement is required to splay no more than 15° from a line perpendicular to the wall face (*see* diagram below). This angling of ground reinforcement is typically used to avoid obstructions, such as drainage structures, which may be located just inside the MSE wall structure.

Field changes to ground reinforcement to avoid obstructions should not be made unless shown on the approved drawings. The figure below illustrates the concept.



MSE Wall Plan View

Grading around and backfilling of the wall must be carefully inspected to ensure proper, uniform, and level lift placement. Improper grading around the wall can cause component failures. Careless placement and improper compaction methods used in constructing the backfill can cause undesirable wall deflections and reduce overall retaining capacity.

A comprehensive instructional presentation of MSE installation in located at
https://www.in.gov/indot/doing-business-with-indot/files/MSEWall.pptx

Section 30:

Inspection Procedures for Railroad Force Account

SECTION 30 – INSPECTION PROCEDURES FOR RAILROAD FORCE ACCOUNT

30.1 INTRODUCTION

Responsibility for the inspection of the Railroad Force Account (RRFA) work, the review of the work being accomplished to ensure adherence to the agreement between the Railroad and the Department, and the approval of the railroad bills will occur at the DO level. The Railroad Team (RT) for the DO or CO will be available for consultation involving interpretation of the plans, administrative procedures, RT and DO instruction procedures, and salvage values.

Outlined briefly herein are the functions to be performed by the PEMS in making a satisfactory inspection and administration of the Railroad Force Account work.

30.2 AUTHORIZATION

Do not authorize a railroad to begin work until a copy of the authorization letter has been received from the RT.

The existence of an executed agreement by itself does not constitute authority to proceed with the work. The value of any Railroad work accomplished, special materials ordered, or any other cost incurred prior to the date of FHWA authorization will be cited and deducted from reimbursement by the FHWA. This applies whether the determination to make an early start is the fault of the Railroad, the Department, or local government representative in authorizing the Railroad to start in advance of FHWA approval.

30.3 RAILROAD GRADE CROSSINGS

Prior to receiving bids on a contract, those railroads having grade crossings are advised of the planned highway construction by the RT. However, upon award of the contract, the PEMS, in cooperation with the DCD, must contact the appropriate railroad officials and arrange a meeting on the site. The railroad should always be invited to the pre-construction conference. This may eliminate the need for a separate meeting on the site. At this meeting, railroad officials should be advised of the Contractor’s schedule of operations. Coordination of the railroad’s work plan with that of the road contractor’s work plan should also be reviewed.

A Railroad agreement will establish a mechanism for obtaining personnel to ensure contract zone safety. If the Railroad has actual construction activities, it is normally work on their right-of-way and with their own forces. The PEMS must provide sufficient inspection of the railroad construction work so at the completion of the work, there is documentation supporting the work substantially complies with the plans.

Normally, when work is performed by a Department Contractor within the railroad ROW, or within 50 feet of the nearest track, the Contractor is required to provide Railroad Protective Liability Insurance. An insurance policy must be received by the Railroad from the Contractor’s insurer before the Notice to Proceed will be issued. If the work encroaches to within 25 feet of the tracks, a flagger, at the discretion of the Railroad, may be required to be present for any work to occur. The flagger will be paid for by the Department. The RT, working with the PEMS will have sole authority for releasing any Railroad personnel assigned to the contract utilized for the purpose of flagging.

Some railroads will adjust their tracks exactly to the planned road grade, others may have a policy of leaving the tracks slightly high in anticipation of subsequent settlement. When power-tamping equipment is used to compact railroad ballast, no allowance is necessary for settlement. This method should be encouraged. In either event, it is important that the PEMS, or the Contractor through the Construction Engineering item, provide the track foreman the necessary grade stakes. The PEMS will inspect the staking and track adjustment work sufficiently to verify a smooth riding header and crossing. A poor crossing can result in damage to the adjacent pavement from the impact of heavy motor vehicles.

Sufficient profiles and cross sections should be taken at all railroad crossings to build a smooth grade. Skewed crossings and tracks on super-elevated curves are often difficult to match with the road construction. If possible, tracks should be adjusted to the same elevation at crossings where two or more tracks are at different elevations. When the track adjustment is an appreciable amount, the Railroad should make the change as early as possible. In this manner, their track roadbed will have had an opportunity to become stabilized prior to paving. The final adjustment, if necessary, would then be only minor and the tracks would maintain their permanent elevation. If it appears that the Railroad will be required to lower its track to meet the planned grade, the PM must be notified so that adjustments to the design can be made. It is not desirable to attempt to lower the grade of an existing railroad.

If a crossing is to be installed as a part of the contract work, a copy of the current “General Specifications for Construction of Highway Railway Grade Crossings” will be included in the railroad agreement. These are to be treated the same as SS for the contract. The Scope of the Work Exhibit should be reviewed for any other work planned to be performed at the crossing. Certain pre-manufactured crossing surfaces will be indicated to be installed in accordance with the manufacturer’s specifications. A copy of these specifications should be on file in the DO and the PEMS should obtain a copy for use and include a copy in the contract files.

Become familiar with 107.09 “Railroad-Highway Requirements”, and 107.20 “Contractor’s Responsibility for Utility Property and Services” of the SS. These sections may be modified and added to contracts as a special provision. Quite often the road contract will include work for placing drainage culverts through the railroad embankment. This work will normally be planned for by either open cutting or jacking. Although work of this nature is a part of the Railroad Agreement and has been cleared with the Railroad during the design stage, the Contractor is not relieved of his responsibilities as set out in the SS and the contract.

The SS require that protection arrangements for work performed by the Department’s Contractor effecting the tracks and movement of trains during the construction period must be approved by the Railroad. It is the responsibility of the PEMS to verify that the Contractor complies with these requirements. In addition to the normal procedure for approval of cofferdams at Railroad structures, the SS requirement for notification of, and approval from, the Railroad will apply on construction and maintenance contracts for:

a. installation of new grade crossing headers,
b. widening of an existing grade crossing,
c. installation of a pipe under the tracks, or
d. any other operation likely to affect the tracks or operation of the railroad.

Notification and approval by the Railroad of the above-mentioned protection arrangements will be required regardless of whether there is a formal railroad agreement between the Department and the Railroad. On LPA projects with Federal-Aid funding, there will be a written crossing agreement between the county or municipality and the Railroad with the Department acting as agent and utilizing the same specifications.

If the minutes of the pre-construction conference document that a Railroad representative was present to discuss construction involving the Railroad, these minutes will suffice for notification by the Contractor to the Railroad. However, written approval for the method of work to be used must be obtained by the Contractor from the Railroad and verified by the PEMS.

At crossings where active warning devices are to be installed, the Railroad Agreement will contain the current “General Specifications for Installation of Active Warning Devices at Highway-Railway Grade Crossings”. The railroad will design the crossing surface and signal location. The details of the design can be found in an exhibit to the railroad agreement. The crossing layout in the Force Account Exhibit will show, by symbol, the use of additional light pairs, cantilevers, and any other equipment to be installed outside of the control cabinet.

30.4 PRE-CONSTRUCTION CONFERENCE/RAILROAD CONFERENCE

Where multiple Railroads are involved in a contract, it is essential to discuss a workable schedule that coordinates with the Contractor’s schedule. A railroad conference should be held in conjunction with the usual pre-construction conference, and the RT must be informed of the pre-construction conference date. The PEMS is required to prepare minutes of the railroad conference for inclusion in the pre-construction conference minutes.

At the railroad conference, and as previously noted, each railroad company supervisor should be cautioned against starting work prior to receipt of proper authority or making any substantial change in the scope of work without prior approval. Failure to get such approval will restrict reimbursement for such advance or substantially revised work.

A copy of the minutes of the pre-construction conference involving the utility phase should be forwarded to the RT for inclusion in their file and their use in the engineering review of the Railroad billings. The proposed scheduled starting dates, anticipated completion dates, and any applicable or intermediate date must be recorded.

The date the Railroad was contacted regarding starting their work, the date the Railroad actually started work, and any adverse conditions causing delay in the sequence of operations should be recorded in the pre-construction minutes. The PEMS should note specific items of assistance provided to the Railroad such as locating the centerline of the road, establishing grade stakes in advance of normal staking, etc. A comprehensive review of the work to be performed should be made at the start of the Railroad Force Account work.

30.5 INSPECTION

The degree of inspection of Railroad Force Account construction will vary considerably with the nature and location of the work and the type of contract involved. Judgment must be exercised regarding the manner and regularity of inspections. The inspection may vary from spot checks on some installations to detailed inspections of crossing construction and grade separation projects.

The following items should be noted by the PEMS:

a. Verify that proposed grade and alignment are in accordance with the approved railroad plans and are compatible with the road structures, and construction features, etc.

b. Verify that proper backfill methods and materials are used where proposed and future road surfaces and berms are involved.

c. Be observant for any substantial change in methods and materials from those approved, such as the use of sheeting, special backfill, etc. The PEMS should immediately contact the Railroad representative to determine whether the Railroad or its Contractor expect to receive extra compensation for performing such work. Such a change, if compensable, can be approved by the RT. However, such approval must be obtained prior to starting the procedure change.

d. Verify that the Railroad foreman is familiar with symbols furnished on the construction stakes, such as cut and fill information, and that both the Railroad and the Department use the same data.

e. Spot checks should be made to verify that depths are compatible with Department plans, vertical clearances of overhead installations are sufficient to ensure proper clearance distance from highway structures, and horizontal alignment is compatible with construction limits, access lines, etc.

Railroads are authorized, after the PEMS has obtained the verbal approval of the DO, to do all necessary work involving minor changes in quantities or additions of minor items not included in any approved estimate. These changes are those deemed necessary to accomplish the intent of the approved agreements and do not require formal approval from the RT. However, adequate documentation and justification of such minor changes, items of material, and work performed must be attached to the record kept by the PEMS to aid Internal Affairs in any audit review.

RT approval must be secured for substantial changes in the scope of work that may affect the cost, such as:

a. a change in width of the crossing,
b. change in elevation of wire, (causing different length poles to be used),
c. special footage,
d. extra guying, bracing, sheeting, dewatering, and
e. changes in location or alignment.

In non-emergency situations, the proposal for such a change must be submitted in writing by the Railroad to the RT, and is required to provide as much detailed information as practical. Sketches, estimates (if work is being performed by the Contractor, the Designer's estimate should be made prior to the Contractor's proposal for same), costs and other documentation should be required and transmitted.

The RT will base the determination of the Railroad's request on the PEMS' opinion of the necessity or desirability for the change. The request should indicate whether the changes result from (1) unusual field conditions not considered by the Designer, (2) changes made by the Department's Contractor, or (3) mutual agreement that a change is desirable.

After approval by the RT, the RT will send copies of the approved design changes to the DO, the PEMS, and the Railroad. The PEMS must inform the Railroad in writing of approval of field changes. The PEMS must also forward a copy of the approval of field changes to the DO and the RT. If timing is a critical factor, the PEMS may contact the RT by telephone for their assistance followed by a memorandum for the record. In these emergency situations where the RT has been asked for assistance by the PEMS, the appropriate RT personnel will contact the FHWA, review the problem with them, and request their concurrence in the change, subject to receiving the above-described documentation from the field. The RT will confirm the approval after receipt of the appropriate documents from the field, with a copy to the Railroad.

It is recognized that it may be difficult to define or otherwise describe the limits of "substantial change" due to variations in cost of work, its complexity, the variable situations, and terrain encountered. It is also undesirable to request RT approval for every recognizable change. However, in case of doubt and where considerable amounts of money are involved, the RT should be contacted for approval as directed above.

30.6 RECORDS

The record of the PEMS for the Force Account work should be kept in sufficient detail to indicate that the stages of the work were performed in conformance with the plans and scheduling. This record will also be used in preparing the final letter recommending acceptance and payment for the Railroad Force Account work performed. The various methods of payment of the Force Account relocation work may result in differences in the records required to be kept at the construction level. These are described below:

a. For contracts performed entirely by the Railroad with Railroad forces, the record kept by the PEMS should include the number and class of employees, major equipment on site, principal materials used, and materials removed from the site. Also, pertinent data such as weather conditions, ground conditions, breakdown of equipment, delays due to conflicts with other Railroad forces or Contractor's operations, should be recorded. Any conversations with the Railroad or the RT should be documented in the contract files.

b. On the few contracts where part or all the Railroad work is being performed by a Contractor having a continuing contract with the Railroad, the same records are required as in (a) above, unless the agreement clearly established that the work being performed under a continuing contract is on a unit of work basis. If it is clearly on a unit of work basis, only the units of work completed per day by the Contractor need be recorded. Records on any work performed by the Railroad's forces in conjunction with a continuing contract should follow part (a) above.

c. For contracts being performed in part or completely by outside Contractors, on a unit of work basis, the record should cover the units of work performed on a daily basis. On contracts being performed in part or completely by an outside Contractor, on a lump sum basis, the items of recording labor and equipment used by the Contractor can be deleted from the record, except in those instances when extra work performed by the Contractor on a per hour or per diem basis is involved. The units of work completed should be recorded daily to form a basis for checking payment to the Railroad for their Contractor's work. This should include such things as the number of poles installed, amount of wire strung, the lineal footage of pipe installed, the length of line removed, the quantity of trenching performed, tons of ballast placed, number of ties laid, length and weight (size) of rail installed or changed, number of crossing sections installed, lineal footage of track resurfaced, or any other work unit.

d. On lump sum agreements between the Department and the Railroad where the construction work is being performed either by Railroad forces or by the contract method, the daily checks on the manpower, equipment, and material can be omitted. However, a detailed review must be made at the final Railroad inspection to ensure conformance with the agreement. In these instances, the Railroad will be paid the exact amount of the original or duly modified agreement regardless of the actual cost incurred by the Railroad, as long as they have satisfactorily performed all work covered by the approved plan.

Records should be kept clearly indicating the hours for the Railroad's inspection personnel with particular emphasis on those not on the Railroad payroll.

30.7 SALVAGE MATERIAL

If salvageable materials are encountered, the PEMS should contact the DO immediately. It is essential to account for all materials removed from the site. The Railroad must have the scrap or salvage materials available for inspection. In the interest of cooperation and liaison with the Railroad, the PEMS should remind the Railroad representative of this requirement. The Railroad will be held responsible for the full value of the item, whether of salvageable quality or not, if it is disposed of without first notifying and getting approval to do so from the Engineer.

The following definitions are provided as a general guideline:

SALVAGE - Materials which have been recovered from project work by the Railroad or Contractor and are accepted for re-use and return to Railroad storage. The Department shall receive reimbursement for all salvage material. The amount shall be credited to the contract cost. In determining salvage values, the following criteria should be followed: (1) For all materials recovered from temporary contract use, the Railroad or Contractor shall give credit to the total contract cost, less a depreciation allowance of 10% for rails, angle bars, tie plates, and metal turnout materials and 15% for all other materials. (2) All materials recovered from the permanent installation will be credited to the total contract cost at current stock prices.

SCRAP OR SALABLE - Materials which have been recovered by the Railroad or Contractor from contract work and are not acceptable for re-use, but are salable items and are too valuable to junk. If these materials have a net sale value, then the Department will inspect the materials and provide authorization for their sale. The Department, or the Railroad, will advertise these items for bids and sell the materials to the highest bidder, or the Railroad may retain the materials if they conduct periodic sales. If sold in a Railroad periodic sale, credit given for these materials will be based on Railroad records of these periodic sales. If lengths or quantities of any materials installed are less than those removed and if such removal increases operating costs to the Railroad, then the amount of credit given to the Department may be reduced.

JUNK - Junk is material that has no salvage or scrap value. Such junk material is to be destroyed by the Railroad under Department supervision.

When abandonment in place is identified for particular parts or all of a facility and the abandonment will, in the opinion of the DO, constitute a hazard or liability to the Department, the Railroad, the Contractor, or adversely effects the work of the Contractor, it will be treated as a substantial change. Approval to remove the facility must be requested from the RT. Rails located within the roadway are not to be abandoned in place. Their removal will be considered incidental to the contract. After approval by the RT, the Railroad should be instructed to remove the facility and documentation of the change placed within the contract record. In general, the opinion of the RT is that all pipe 12 in. or less in diameter may be abandoned in place when concurrence is received from the Designer and FHWA. Poles, after being pulled and hardware removed, may be abandoned on the Railroad’s ROW. The final decision on abandonment shall be the responsibility of the DO and/or the railroad concerned.

After a review by the PEMS of any recovered poles, pipes, rails, ties, or other material-which the Railroad has declared to not be salvageable, but is determined to be salable, the material shall be disposed of by the Railroad through invitational bids, if the estimate of value or amount of material warrants such action. Otherwise, the unsalable material shall be taken to an established disposal yard, abandoned outside construction limits, or otherwise disposed of and documented accordingly. Any pipe abandoned under tracks greater than 12 in. diameter must first be adequately filled with suitable material and the ends plugged with concrete.

30.8 FINAL INSPECTION OF RAILROAD FORCE ACCOUNT

At the conclusion of the Railroad work, a final inspection will be made by the RT, in the presence of the Railroad representative and their Contractor, to determine conformance with the approved original or modified plan. The RT will perform the final inspection and record the results on the Rail Crossing Final Inspection Report, form 40908.

When the RT Section is advised by the Railroad that completed work has been placed in service, a final inspection meeting is scheduled with representatives of the Railroad, the DO, and the FHWA utilizing the following procedures:

A. *Modern Active Flashing Light Signals*

1. The location and lateral clearances are checked to determine compliance with the plans and FHWA requirements.
2. The signal assembly, mast, instrument case and battery well are checked to determine if all construction was performed in a workman-like manner.
3. The painting of all units is inspected.
4. The roadway is driven from both approaches with the flashing light signals in operation to determine if the flashing light units are properly focused and functioning properly.
5. If a train crosses the intersection during the inspection period, the time elapsed from the start of flashing operation until the arrival of the train is determined and documented. Discuss this situation with the RT for additional documentation.
6. The lengths of circuits are checked to determine that the warning devices will be in operation a minimum of 20 seconds before the arrival of the fastest train.
7. Documentation is made of any highway obstructions to the visibility of the flashing signals.

B. *Modern Active Flashing Light Signals with Short Arm Gates*

In addition to the above procedure, tests are conducted to determine if the installation complies with the following requirements:

1. Gate arm lights must operate in conjunction with the highway crossing signal. The light nearest the tip of the arm must burn steady and the remaining two lights must flash alternately and in unison with lights on the signal.

2. The gate must start its downward movement not less than 3 seconds after the signal starts to operate.
3. The gate arm must reach the horizontal position before arrival of any train and remain in this position until the rear of the train has cleared crossing.
4. The bell must sound a warning from the time the signal lights start to operate (minimum of 20 seconds before arrival of the train) until the gate arm is in the horizontal position.
5. The gate arm must return to the 90° vertical position.
6. The time of operation from full horizontal position to raised position must be from 9 to 12 seconds.
7. Two sources of power must be provided for the operation of the grade crossing warning devices.
8. If the signals are interconnected with traffic signals for railroad preemption of the highway signals, DT must be requested to attend the final inspection performed by RT and to verify that the preemption is functioning as specified in the railroad agreement. The RT will record the amount of advance warning time provided on the Rail Crossing Final Inspection Report form 40908 as "Preemption time".

C. *Advance Warning Signs and Standard Pavement Markings*
Crossings will be checked for:

1. Pavement markings, as shown in the MUTCD, have been used on all paved approaches to Railroad crossings. Such markings are the responsibility of the public authorities.
2. Advance warning signs have been placed off the Railroad ROW appropriately. The signs are the responsibility of the public authorities.

30.9 TRANSMITTING RECORDS

The PEMS must keep the force account record at the contract field office until obtaining receipt of the final railroad billing from the RT. The record will be used in reviewing the partial and final billings. Afterwards, the record must be attached to the recommendation for approval letter for final billing. The RT will then transmit the billing to Contract Audit for financial review and final payment. RT will retain the PEMS record in their files.