



Construction Manual for Construction Project Inspection

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SECTION A: INTRODUCTION

INTRODUCTION

Publication 8 (PUB 8), Construction Manual, updates the previous version of PUB 8, dated 2008.

The Construction Manual is to be used as a guide and a reference for the inspector in the field. It contains valuable information not found in other manuals or publications. This manual should assist the inspector in performing inspection duties by providing what is considered good construction practices for the different phases of a project. The contractor may have a better method than those outlined herein but must obtain the same result.

This manual will reference PUB 408, standard drawings, and other contract documents, but it is NOT a contract-governing document. PUB 8 is not a substitute for any of the current published standards, publications, and/or policies the Department has in place and is intended solely for use by Pennsylvania Department of Transportation (PennDOT) employees and representatives. The information contained in PUB 8 has been developed based on PUB 408/2020. Since changes do occur, users of this manual are to determine the PUB 408 version applicable to their project and whether the contract documents include any special provisions that would modify the information that is presented in this manual.

Each main section will cover goals and safety relative to the section content. The subsections within each section are organized using the following format:

- Subsection Title & Introduction
- Before, During, & After Operation Checklists
- Material & Equipment
- Construction Methods
- Measuring & Payment Methods

1. DIGITAL NAVIGATION

The Table of Contents contains internal hyperlinks to corresponding sections within the manual. However, the primary method for navigating the manual is through the utilization of embedded bookmarks. To navigate the manual using bookmarks, locate the bookmarks panel, typically situated on the left side of the PDF viewer, then click on the desired bookmark to navigate to the corresponding section of the document.

2. SUBSECTION TITLE & INTRODUCTION

Each section in this manual features subsections corresponding to relevant sections in PUB 408, with the referenced PUB 408 section number(s) appearing next to the respective section title in parenthesis. The "Introduction" provides a summary of the subject matter in each section.

3. OPERATION CHECKLIST

While all content in this manual is important, the "Operation Checklists" are considered the heart of the manual. These checklists identify the key elements that must be considered before, during, and after a given construction operation.

Each checklist is comprised of a series of tasks, all of which are to be completed by the inspector. Tasks with a pencil () symbol indicate that the inspector is required to document information specific to the construction operation in their Project Site Activity (PSA) report.

Some "Before Operation" checklists contain links to operational training videos or presentations that should be reviewed prior to the operation being inspected.

4. MATERIAL & EQUIPMENT

The "Material and Equipment" sections contain written explanations of typical materials and equipment used in an operation. Additionally, each Material and Equipment section will contain an Equipment Table. Each table contains hyperlinks that can be used to perform an automated image search in the device's default web browser for that specific piece of equipment.

5. CONSTRUCTION METHODS

Means and methods are at the discretion of the contractor. However, the "Construction Methods" sections featured in this manual encompass well-established industry practices that delineate the typical procedures for constructing roadway infrastructure. These common practices serve as a valuable reference for inspectors when establishing clear expectations for the execution of construction operations.

6. MEASURING & PAYMENT METHODS

Work performed on the project will be measured in units shown in the "Measurement and Payment" sections of PUB 408 and the design items in the proposal unless otherwise specified. Payment for items of work performed will be made at the contract price per these units of measure

Section A: Introduction

for the item complete in place or portions thereof. Unless otherwise specified, the contract unit price will cover all costs for materials, labor, and equipment. The sections on "Measuring and Payment Methods" will provide a comprehensive explanation of how the project will quantify and compensate for specific operational elements.

7. REFERENCES

References can be found in Operation Checklists, Reference sections at the end of each main section, and various other places throughout the manual. References indicated in a [blue underlined font](#), are external and internal hyperlinks that can be used to quickly navigate between the reference material and PUB 8.

8. APPENDIX A: FIELD WELDING

Appendix B contains information for inspecting field welding of various steel structures.

9. GLOSSARY

The glossary contains a list of abbreviations and definitions.

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SECTION B: TRANSPORTATION CONSTRUCTION INSPECTOR

GOALS

- Ensure a safe project is completed to high quality, on time, and within budget.

SAFETY

- **Traffic Control:** Review devices and properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** A construction project has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Back Up Alarms:** Monitor equipment for working backup alarms. Inform the contractor's supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Contractor Safety Plan:** Be familiar with the contractor's safety plan and ensure it is being followed by all personnel on the project, including all subcontractor personnel.
- **Mobile Device Usage:** Cell phones and tablets should only be used outside of active construction areas, away from moving equipment and traffic.

1. TRANSPORTATION CONSTRUCTION INSPECTOR

This section addresses the responsibilities, duties, and competencies of an inspector.

The inspector performs a variety of technical duties in the inspection of materials and work on a construction project to ensure all work is completed in conformance with approved construction contracts, plans, standards, and specifications. The inspector also inspects all phases of transportation construction work and assists with checking grades, elevations, structure stakeouts, and roadway stakeouts with the contractor and surveyor.

The work includes inspecting the placement of materials such as cement concrete, asphalt concrete, drainage materials, and all applicable materials, as well as compaction testing of subsurface strata, soils, and aggregate. The inspector also interacts with Department staff, other federal, state, and local agencies, adjacent property owners, and the public to ensure the effective administration of the projects.

The inspector is required to complete and perform daily Project Site Activity (PSA) entries, mathematical calculations, item quantity estimates, project cost estimates, work orders, and all applicable project documentation electronically. The inspector also assists in resolving field problems that are encountered.

The inspector is authorized to make inspections of contract performance and material furnished. The contractor must provide access to the work and furnish every reasonable facility for the inspector to verify the work being performed or completed is in accordance with the requirements of the plans, specifications, and contract. If work is performed during nighttime hours, sufficient artificial lighting must be provided.

The inspector is not authorized to do the following: revoke, alter, enlarge, relax, or release any requirements of the specifications; approve or accept any portion of the work; or issue instructions contrary to the plans and specifications. The inspector's presence during the performance of any work on the project does not relieve the contractor of responsibility for work later determined by the Department Representative to be defective.

☐ Review  Documentation Required

A. RESPONSIBILITIES OF THE INSPECTOR

☐ 	Task	Reference
☐	Review and enforce the specifications, standards, contract, plans, and permits.	MCDocs
☐	Inspect the contractor's operations to verify work is being performed in accordance with the contract and permits (before, during, and after).	
☐	Perform quality checks throughout the operation (before, during, and after).	
☐	Do NOT direct the contractor on what or how to do their work.	

Section B: Transportation Construction Inspector

☐		Task	Reference
☐		Inform the contractor if they are not doing something per the specifications, standards, contract, plans, and permits. Escalate to Inspector-in-Charge (IIC) if not corrected.	
		Communicate with the IIC, contractor, and other project personnel. No question is stupid; everyone was a rookie at some point.	
☐		Develop proper documentation at the end of each day, sufficiently detailed in PSA entries as indicated under PUB 8 Section 100.7 Project Documentation .	

B. DUTIES OF THE INSPECTOR

☐		Task	Reference
☐		Conducts research and plans work. Reads specifications and contract special provisions and reviews plans and standard drawings. Obtains appropriate tools and equipment to conduct inspections. Monitors weather for job impacts.	MCDocs
☐		Promotes job site safety. Reviews and enforces Maintenance and Protection of Traffic (MPT) per PUB 213 . Read the contractor's safety plans and inspect the work site for safety hazards.	PPCC
☐		Ensures environmental regulations are followed. Reviews erosion and sediment (E&S) controls and enforces environmental permit requirements. Ensures hazardous waste is handled in accordance with special provisions.	MCDocs
☐		Inspects work. Reviews and coordinates activities with the contractor. Monitors work to ensure proper procedures are being followed, including compliance with specifications, contractor quality control (QC) plans, and approved work plans.	PPCC
☐		Ensures all subcontractors performing work are approved in ECMS. Notify the IIC if they are not approved.	
☐		Ensures the contractor is following approved QC plans and QC testing is conducted at the proper locations and intervals.	PPCC
☐		Performs calculations and documentation. Calculates quantities of work performed and completes a PSA daily. Update as-built plans as needed.	
☐		Conducts wage rate interviews to ensure contractors' compliance with the required prevailing wage rates.	

Section B: Transportation Construction Inspector

☐ 	Task	Reference
☐	Communicates and collaborates with contractors, inspectors, and IIC.	
☐	Performs material sampling and testing for acceptance of material.	
☐	Obtains and is knowledgeable of Form CS-8 Issue Escalation Matrix.	PPCC
☐	Obtains and is knowledgeable of emergency contacts.	PPCC
☐	Is an active participant in the work, engage, and ask questions.	
☐	Reviews and follows the Commonwealth Public Official and Employee Ethics Act . See State Ethics Commission's Ethics Act for additional details.	
☐	Reviews and follows Executive Order 2023-04 – Executive Branch Employee Gift Ban and Executive Order 1980-18 – Code of Conduct .	
☐	Utilizes basic inspection tools such as tape measures, measuring wheels, survey lock levels, thermometers, concrete slump cones, air meters, and other miscellaneous instruments and devices.	

C. COMPETENCIES OF THE INSPECTOR

Attention to Detail: Is thorough and conscientious when performing work; makes value judgments concerning the details of the job; knows which details are the most important and which are of lesser importance.

Communication-Listening: Listens to technical information to acquire knowledge on a topic or information on a situation; identifies and clarifies miscommunications between others.

Communication-Written: Recognizes and uses correct English grammar, punctuation, and spelling; communicates information in a succinct and organized manner; creates sketches of work performed and basic drafting drawings.

Conscientiousness: Displays an elevated level of effort and commitment towards performing work; demonstrates responsible behavior, functioning with little or no supervision.

Continuous Learner: Uses a variety of methods to achieve and maintain technical competence; seeks out and attends courses, workshops, and conferences; seeks out subject matter experts as coaches; refers to and continually updates technical resource documents; seeks out opportunities to expand their knowledge base; participates in projects to expand competence and contribute to organizational excellence.

Decision Making: Understands project goals; when encountering obstacles, seeks input from subject matter experts and key stakeholders to generate alternatives; considers risks, evaluates, and recommends solutions; recognizes problems they can solve; and recognizes those that require decisions to be made at a higher level.

Section B: Transportation Construction Inspector

Flexibility: Adapts quickly to changes in plans; adapts work methods in response to new information, changing conditions, or unexpected obstacles.

Honesty/Integrity: Displays a high standard of ethical conduct and understands the impact of violating these standards on the organization, self, and the public; is trustworthy, even when faced with offers of personal gain.

Influencing/Negotiating: Persuades others to accept recommendations or perform work required by the project without the position of power to enforce compliance; works with others toward a mutually acceptable solution.

Information Management: Identifies the need for and knows where and how to gather the information needed for work to proceed; organizes and maintains information or information management systems.

Interpersonal Acumen: Shows understanding, courtesy, and concern; develops and maintains relationships with colleagues, partners, and the public; deals appropriately and effectively with people who may be difficult or distressed.

Mathematical Reasoning: Performs computations involving basic math functions, geometry, and trigonometry and applies the computations appropriately to construction and material applications.

Mental Visualization: Sees things in the mind by mentally organizing and processing symbols, pictures, graphs, blueprints, and work plans.

Observant: Notices the details of the operation and the site where the work is to be performed. Identifies special situations that may require specific safety measures or a different approach.

Organized: Works in a logical and effective sequence and keeps multiple operations moving forward simultaneously.

Problem Solving: Identifies problems; determines the accuracy and relevance of information; makes recommendations or presents alternatives based on data, information, standards, and field conditions.

Reading: Understands, interprets, and retains information from written material, including highly technical material, rules, regulations, charts, and graphs; applies what is learned from written material to the appropriate specific situation.

Self-Management: Displays an elevated level of initiative, effort, and commitment toward completing projects in a timely manner; works with minimal supervision; is motivated to do excellent work; demonstrates responsible behavior.

Teaching Others: Helps other less experienced workers learn through informal methods, provides constructive feedback, and coaches others through the steps of a task at the project level.

Technical Competence: Uses knowledge that is acquired through formal training or extensive experience to perform the job; works with, understands, and evaluates technical information related to the job; advises others on technical issues.

Technology Application: Uses field and office equipment, tools, and instruments effectively; uses tablet computers and computer applications to record, develop, and communicate data and information.

D. RELATIONS WITH CONTRACTORS

Department personnel and inspectors should cooperate with the contractor and the contractor's representatives in accomplishing the work. It is, however, the Department and its inspectors' responsibility to strictly enforce all contract requirements, specifications, special provisions, and drawings.

The contractor is responsible for the entire project from the date the notice to proceed is issued until final acceptance, as noted in the acceptance certificate. The presence of Department personnel and inspectors does not relieve the contractor of their responsibility to perform all work in accordance with the contract documents.

The contractor must assign a superintendent or representative to the project who is experienced and familiar with the work and PennDOT's policies and procedures. The inspector cannot act as the contractor's superintendent or foreperson nor operate or adjust any of the construction equipment.

However, if the contractor's representative or superintendent fails to control the work effectively, it is the duty of the inspector to notify the IIC. If poor workmanship is found on an operation or any item of work is found unsatisfactory, resulting in construction that does not comply with Department specifications, the inspector should immediately notify the contractor's foreperson and not provide instructions directly. The inspector should not give orders to laborers or other workers on the project.

If the contractor fails to take corrective action, the inspector should immediately notify the IIC. All facts, including warning dates, detailed records, and any agreements made, should be recorded in a PSA.

The inspector should know in advance what materials and equipment the contractor will use and be an active participant in the work operation by being engaged with the foreperson by asking questions and sharing observations, including offering the contractor any advice that will help the contractor perform the work according to specifications. The inspector has the authority to reject materials or hold up work that does not comply with Department specifications until a decision can be obtained from the IIC or designated authority.

The inspector should obtain a copy of the Issue Escalation Matrix (Form CS-8) and be aware of the timeframes to escalate an issue.

When it is anticipated that the contractor may request additional compensation or submit a claim, the inspector should keep detailed records of all labor, materials, and equipment used on this part of the work. Further guidance will be provided by the IIC.

The IIC assigns the inspector to an operation, who should remain on the assigned project until all work has been completed. If the contractor desires to complete certain operations beyond normal working hours, the assigned inspector should remain on the project and notify the IIC.

The inspector should obtain a copy of emergency procedures and contacts and follow them in an emergency.

The inspector should learn about the equipment being utilized on the project and what inspection points are critical to ensure it is being utilized properly and performing as planned to result in a high-quality finished product.

E. TRAINING

Asphalt Paving for Construction Inspectors
ACI Concrete Field Testing Technician Course
Basic Math for Construction Inspectors
CMP-CSI (9 Lessons)
District-Specific Winter School Training
Fall Protection
Guide Rail Installation, Inspection, and Maintenance
Inspector Training Workshop (ITW)
Introduction to Documentation Procedures
Introduction to Inspection
Mobile Construction Apps
NECEPT Asphalt Field Technician Annual Update/Refresher Course
NECEPT Asphalt Field Technician Review and Certification Course
NECEPT PennDOT Concrete Field Testing Technician Certification
NICET Transportation-Highway Construction Inspection
OSHA 10-Hour
PDW Construction App Training
PennDOT Certified Aggregate Technician
PennDOT District Construction Winter School
Proprietary Traffic Barriers and End Treatments
Senior Inspector-In-Charge Training Workshop (SIIC)
TA-TCI 12 Training Modules

Additional training can be found on the [PennDOT Training Calendar](#). Select “By Topic” under Courses. Then select “Construction Inspection.”

District-specific Winter School Training Presentations are available for review under the [PennDOT Project Collaboration Center](#).

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SECTION C: ECONSTRUCTION

INTRODUCTION

This section addresses the mobile applications (apps) and software used on construction projects, also known as eConstruction. The integration of mobile devices and apps significantly enhances the efficiency of construction inspection. Inspectors equipped with tablets or smartphones can input real-time data, capture images, and access digital plans on-site. This real-time connectivity accelerates the inspection workflow, reduces or eliminates the use of paper, and ensures that stakeholders have immediate access to critical information.

MOBILE DEVICE SAFETY

Inspectors equipped with tablets or smartphones must prioritize safety protocols to mitigate distractions and maintain situational awareness. It is imperative that inspectors use these devices judiciously, especially when navigating complex construction environments, conducting inspections at elevated levels, or working in proximity to heavy machinery. Emphasis should be placed on the importance of designating **safe areas** for device interaction and discouraging their use in potentially hazardous situations. Additionally, the implementation of **hands-free** technologies and **voice-activated** features can further mitigate risks by allowing inspectors to access information without compromising their physical attention to their surroundings.

Beyond physical safety, there are also potential risks related to data security. Mobile devices often contain sensitive information, and the use of mobile devices may expose this data to unauthorized access or compromise if devices are lost or stolen.

1. ENGINEERING AND CONSTRUCTION MANAGEMENT SYSTEM (ECMS)

The Engineering and Construction Management System (ECMS) is one of the most important resources for PennDOT's project delivery process. ECMS covers a construction project from beginning to end, including design, bid, award, management, finalization, and inspection, providing PennDOT, its business partners, and the public with up-to-date information on construction contracts and consultant agreements.

ECMS houses several documentation aspects of a construction project, as shown below:

Setup	Solicit	Award	Construct	Closeout
- Team - Milestones - Program Data (1) - Agreements (0) - Roadways (4) - Segment Equalities - Structures (0) - Fund Codes - Federal Project Numbers - Minority Goal	- Project Conditions - Project Development Checklist - Special Provisions - Design Items - Mitigation - OJT Worksheet - Bid Package 1	- Award Checklist - Minority Solicitations - Minority Participation and Commitment - Component Item Schedules - Bonds - Bid Items - Contract - OJT - Training Program Classifications (EO-363)	- Addresses - Subcontractor Requests - Construction Items - Source of Supply - Material Certifications - Project Site Activities - Contract Work Authorizations - Work Orders - Estimates - Actual Force Accounts - Force Account Estimates - Adjustments - Time Extensions/Reductions - Reassigned (No) - Report Facility - Visual Site Inspections - Construction Mitigation - OJT - Trainee Enrollment (EO-364) - OJT - Trainee Monthly Evaluation Report (EO-365)	- Audits - Construction Records - Contractor Evaluations - Quality Survey for Design Items - Project Punchlist - Finalization Checklist - Acceptance Certificate - Final Quantities
		Contractor Checklist		

The benefits provided by ECMS allow inspectors to manage and monitor an expansive portfolio of road and bridge construction projects more effectively, reducing time to enter information, process work orders and payments, track progress and materials, and have easier access to records and documents associated with each project.

An [ECMS User Guide](#) is available to assist inspectors in navigating and effectively utilizing the site.

2. PENNDOT PROJECT COLLABORATION CENTER (PPCC)

The PennDOT Project Collaboration Center (PPCC) was developed to expedite Submittal Requests efficiently and serve as a versatile repository for the seamless storage and retrieval of construction documentation records from any location with internet access. PPCC consists of a central Project Portal site and individual Project Sites tailored to each project.

As the submittals are placed in PPCC, it is important to monitor the response times and ensure items are addressed. It's not uncommon to have hundreds of submittals for any given project, which is why it is critical to stay as current as possible.

Inspectors should review approved operation-specific submissions in PPCC, including but not limited to Requests for Information (RFIs), other correspondence, meeting minutes, quality control (QC) plans, cut sheets, shop drawings, and work plans prior to the start of work operations.

In addition to project-specific documents, PPCC houses various operation-specific presentations, user guides, and other reference material under the [Reference](#) tab. Enter a keyword in the search field at the top of the page to find specific reference material.

A [PPCC User Guide](#) is available to assist inspectors in navigating and effectively utilizing the site.

3. MOBILE CONSTRUCTION DOCUMENTS (MCDOCS) APP



The Mobile Construction Documents (MCDOCS) app provides easy access through a unified gateway to construction-related documents from three disparate systems: the PennDOT SharePoint site, ECMS, and PPCC. Users must log in to the app using their Commonwealth of Pennsylvania (CWOPA) and/or Business Partner (B-) credentials, view documents for their assigned projects in each of these systems, and select those that they need to download onto their iPads. When assigned to a project, users should download the plans, special provisions, and attachments. PPCC downloads will occur throughout the project on an as-needed basis as submittals are reviewed and approved during the construction of the project. Once downloaded, the documents are available for offline viewing in remote construction areas where a data connection may not be reachable.

An [MCDOCS User Guide](#) is available to assist inspectors in navigating and effectively utilizing the app.

4. MOBILE CONSTRUCTION FORCE ACCOUNT (MCFA) APP



The Mobile Construction Force Account (MCFA) app provides easy access through a unified gateway to ECMS Force Account features. This app allows inspectors to document labor, equipment, and material costs associated with unforeseen or additional work, ensuring accurate accounting and transparency in project expenditures.

An [MCFA User Guide](#) and [training videos](#) are available to assist inspectors in navigating and effectively utilizing the app.

5. MOBILE CONSTRUCTION MAINTENANCE AND PROTECTION OF TRAFFIC (MCMPT) APP



The Mobile Construction Maintenance and Protection of Traffic (MCMPT) app allows PennDOT inspectors to capture, edit, save/sync, search, and retrieve traffic control device data while in the field. This data will populate the related PennDOT ECMS-PSA Traffic Comment Section and Work Zone Traffic Control Compliance Checklist and Notification (CS-901) PDF. The MPT app was also developed to provide a consistent, automated, and simplified tool for PennDOT inspectors to print, share the CS-901 with related PennDOT construction contractors, and request their signatures and acknowledgments more easily and efficiently. So, this app will save time for data entry, review, and sharing/notify by the PennDOT inspectors.

An [MCMPT User Guide](#) is available to assist inspectors in navigating and effectively utilizing the app.

6. MOBILE CONSTRUCTION PUNCH LIST (MCPL) APP



The Mobile Construction Punch List (MCPL) app provides easy access through a unified gateway to ECMS Punch List features. The MCPL app simplifies and enhances the process of identifying and resolving construction-related issues before project completion. Streamlining communication between project stakeholders, MCPL allows inspectors to create and track tasks efficiently, ensuring a comprehensive and organized approach to final inspections. The app contributes to a smoother project closeout by facilitating quick issue resolution and promoting collaboration among the project team.

An [MCPL User Guide](#) is available to assist inspectors in navigating and effectively utilizing the app.

7. MOBILE CONSTRUCTION PROJECT SITE ACTIVITY (MCPSA) APP



The Mobile Construction Project Site Activity (PSA) app allows inspectors to create daily PSA reports while working directly in the field without a data connection. The app dynamically guides the user through the PSA completion process, alerting inspectors to required fields and incomplete items, as well as automating repetitive data capture elements and complex calculations. Then, once in range of a cellular or Wi-Fi connection, users can submit their completed PSAs directly into the Electronic Construction Management System (ECMS), eliminating the need to capture data on paper and reenter it at a computer terminal.

An [MCPSA User Guide](#) is available to assist inspectors in navigating and effectively utilizing the app.

8. MILEAGE AND HOURS LOG (MHL) APP



The Mileage and Hours Log (MHL) app allows consultant inspectors to create their weekly timesheet and mileage reports in the field directly from their iPads. The app dynamically guides the user through the timesheet and mileage submission process, allowing users to mimic the D-38 Consultant Hours and Mileage form.

An [MHL User Guide](#) is available to assist inspectors in navigating and effectively utilizing the app.

9. ECONCRETE APP



The eConcrete app allows PennDOT inspectors to capture, edit, save/sync, search, and retrieve concrete placement data while in the field. The inspector will enter the test result data into the app for concrete placement. This information will then continue through the curing period until the cylinder breaks. Data can then be synced with the Electronic Construction and Materials Management System (eCAMMS) for data retention and future analysis or reporting. Reports can be generated on countless parameters, like comparing concrete strengths, slump, or air content against the original mix design.

An [eConcrete User Guide](#) and [training videos](#) are available to assist inspectors in navigating and effectively utilizing the app.

10. ETICKETING APP



The eTicketing app allows inspectors and contractors to view supplier-generated material tickets and take action. Users can access ticket information for aggregate, concrete, and asphalt deliveries to a project, as well as report individual and cumulative loads of material delivered. The inspector will approve or return the tickets based on the material received at the construction site.

eTicketing [training videos](#) are available to assist inspectors in navigating and effectively utilizing the app.

11. PA GUIDE RAIL APP



PennDOT's Office of Operations and Performance, in coordination with the Bureau of Maintenance and Operations, developed the Pennsylvania Guide Rail app for field personnel to electronically capture guide rail activities such as repairs, upgrades, installations, and removals during or shortly after completion of work and automate the updates to the Roadway Management System (RMS). The app enables PennDOT to maintain an accurate and up-to-date inventory of guide rail and end treatments within RMS. The PA Guide Rail app requires an Esri ArcGIS Online User License to utilize the app. Licensing agreements were created for individuals whom the Districts identified as app users when the app was initially implemented. Due to personnel changes, licensing needs may change over time (i.e., retirement, promotion, separation, etc.). District Management Staff can submit licensing transfer requests to the PA Guide Rail app resource account (CollectorApp@pa.gov). Be sure to include the full name and CWOPA ID of the individuals involved in the transfer (retiring inspector and new inspector). The business owners will coordinate the license switch with the Bureau of Planning and Research's ArcGIS Online Administrator.

A [PA Guide Rail User Guide](#) is available to assist inspectors in navigating and effectively utilizing the system.

12. SAMPLE IDENTIFICATION (SAMPLE ID) APP



The Sample Identification (Sample ID) app enables construction inspectors and materials engineers to submit requests to have their samples tested by the materials lab (Laboratory Testing Section (LTS)). Users can log in to the app using their CWOPA credentials to create new requests, view the results of previous tests, or receive notifications when a sample has been tested. Access to the Electronic Construction and Materials Management System (eCAMMS) is required to use this app. The Sample ID app can be used in place of the paper TR-447 Form.

A [Sample ID User Guide](#) and [training videos](#) are available to assist inspectors in navigating and effectively utilizing the app.

13. VISUAL SITE INSPECTION REPORT (VSIR) APP



The Visual Site Inspection Report (VSIR) app provides inspectors with the ability to submit mandatory routine (daily or weekly) reports for construction sites in compliance with the Environmental Protection Agency's (EPA's) mandate to ensure proper operation of any stormwater mitigation devices specified in permits issued by the EPA or state or local environmental agency.

A [VSIR User Guide](#) is available to assist inspectors in navigating and effectively utilizing the app.

14. ELECTRONIC CONSTRUCTION AND MATERIALS MANAGEMENT SYSTEM (ECAMMS)

The Electronic Construction and Materials Management System (eCAMMS) is a web-based system that allows users to track PennDOT's decisions on the test results, calculate test results, and report on more than 17,000 samples every year. Users must log in to the app using their Commonwealth of Pennsylvania (CWOPA) and/or Business Partner (B-) credentials, view documents for their assigned projects in each of these systems, and select those that they need to download onto their iPads. Inspectors can view concrete and asphalt material test information online instead of traveling to the producer locations to review test results. These test results are also distributed electronically.

An [eCAMMS User Guide](#) is available to assist inspectors in navigating and effectively utilizing the system.

REFERENCES

[eCAMMS User Guide](#)

[eConcrete User Guide](#)

[eConcrete Training Videos](#)

[Engineering and Construction Management System \(ECMS\) User Guide](#)

[eTicketing Training Videos](#)

[Mileage and Hours Log \(MHL\) User Guide](#)

[Mobile Construction Documents \(MCDocs\) User Guide](#)

[Mobile Construction Force Account \(MCFA\) User Guide](#)

[Mobile Construction Force Account \(MCFA\) Training Videos](#)

[Mobile Construction Maintenance and Protection of Traffic \(MCMPT\) User Guide](#)

[Mobile Construction Project Site Activity \(MCPSA\) User Guide](#)

[Mobile Construction Punch List \(MCPL\) User Guide](#)

[PennDOT Project Collaboration Center \(PPCC\) User Guide](#)

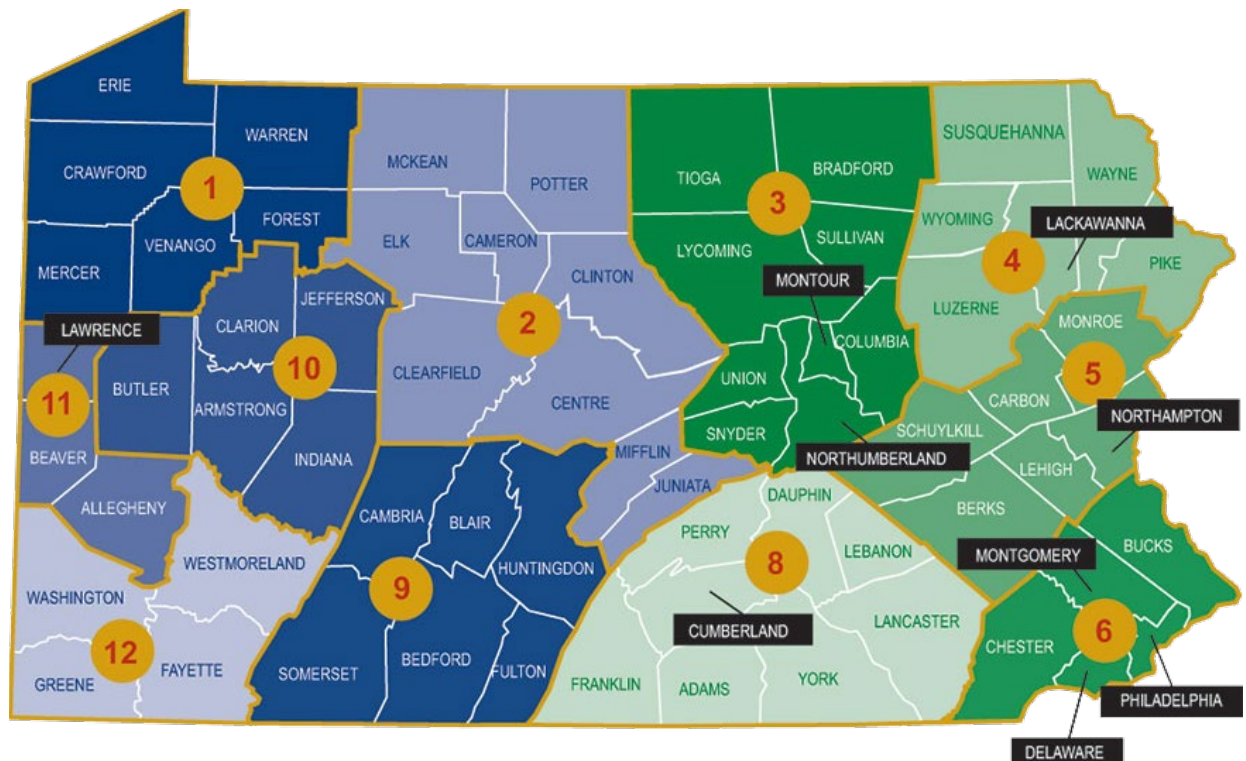
[Sample Identification \(Sample ID\) User Guide](#)

[Sample Identification \(Sample ID\) Training Videos](#)

[Visual Site Inspection Report \(VSIR\) Guide](#)

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SECTION D: ORGANIZATION OF AN ENGINEERING DISTRICT (CONSTRUCTION)



1. ORGANIZATION OF AN ENGINEERING DISTRICT (CONSTRUCTION)

This section addresses the general organization of an Engineering District.

The Pennsylvania Department of Transportation divides the Commonwealth into 11 Engineering Districts, each headed by a District Executive. The District Executive is assisted in the operation of the Engineering District by the following individuals and their staff: Assistant District Executive - Design, Assistant District Executive - Construction, Assistant District Executive - Maintenance, Community Relations Coordinator, District Fiscal Control Officer, and District Human Resources Officer.

A typical District is organized along the following lines; however, it should be noted that several Districts have organizational variances under the Assistant District Executives. For instance, one has a Contract Management Unit in construction, and other units are under different Assistant District Executives depending on the District. Another District has a fourth Assistant District Executive.

A. DISTRICT EXECUTIVE (DE)

The District Executive (DE) is responsible for overseeing all work performed in the District. The work includes all functions such as the design, construction, and maintenance of highways and bridges, coordination with municipalities, the issuance of permits for access to state highways, and the design of traffic signals. The DE's responsibility also includes programming, budgeting, personnel assignments, and performance reviews.

It is the DE's responsibility to ensure that all contracts for work within the District are fulfilled as written, including compliance with the specifications, drawings, special provisions, and standard drawings.

B. ASSISTANT DISTRICT EXECUTIVE - DESIGN (ADED)

The Assistant District Executive - Design (ADED) is responsible for coordinating all activities in the District concerning the design of highways and bridges. The activities include those related to geotechnical issues, structures, planning organizations, and plan and contract development. Surveying, utility relocations, and right-of-way also fall under the jurisdiction of the ADED.

C. ASSISTANT DISTRICT EXECUTIVE - CONSTRUCTION (ADEC)

The Assistant District Executive - Construction (ADEC) is responsible for coordinating all activities related to contract construction work in the District. To accomplish this, the ADEC has a staff that includes a Support Services Engineer, Assistant Construction Engineers/Managers, Materials Engineers/Managers, and individuals responsible for safety, equal employment opportunity (EEO), labor compliance, work orders, finals, and audits. The safety, EEO, and labor compliance functions are often assigned to one individual.

D. ASSISTANT DISTRICT EXECUTIVE - MAINTENANCE (ADEM)

The Assistant District Executive - Maintenance (ADEM) is responsible for coordinating all activities related to accidents, traffic, roadside maintenance, municipal services, access and hauling permits, and maintenance of roadways and bridges, including snow removal in the District. County Maintenance Managers and their staff report to the ADEM.

E. ASSISTANT CONSTRUCTION ENGINEER/MANAGER (ACE/ACM)

The Assistant Construction Engineer/Manager (ACE/ACM) is responsible for overseeing and monitoring several construction projects within the District. The ACE/ACM is the immediate supervisor of the Inspector-in-Charge (IIC) and functions as a coordinator between the IIC and District units to assist in resolving issues and problems.

The ACE/ACM chairs the pre-construction meeting, conducts final inspections, and monitors the progress of the project, including estimates. The ACE/ACM also assists the IIC in resolving compliance issues with the contractor and in obtaining assistance in resolving project issues.

F. STRUCTURE CONTROL ENGINEER (SCE)

The Structure Control Engineer (SCE) is responsible for providing specialized engineering guidance and direction relating to structures. The SCE should inspect all bridge foundations during construction, review deck placement procedures, review falsework submissions, and be consulted whenever non-routine construction problems are encountered. In some Districts, an ACE also serves as the SCE.

G. DISTRICT MATERIALS ENGINEER/MANAGER (DME/DMM)

The District Materials Engineer/Manager (DME/DMM) is responsible for the approval and monitoring of aggregate sources, asphalt concrete plants, and Portland cement concrete plants, which include plants established on the project sites.

The DME/DMM and staff members review quality control plans for the various facilities and project-specific plans for paving operations. The staff provides inspection and monitoring at asphalt and concrete plants, as well as periodic sampling, inspection, and testing of aggregate sources. They are also available for assistance with project-related issues.

H. CONSTRUCTION SERVICES ENGINEER

The Construction Services Engineer is responsible for numerous functions. These functions include monitoring contractors' compliance with labor requirements (e.g., wage rates and trainees), monitoring contractors' safety plans, monitoring contractors' compliance with Equal Employment Opportunity requirements, and processing work orders and other information related to construction contracts. Duties assigned to the construction services engineer may vary by District.

I. INSPECTOR-IN-CHARGE (IIC)

The Inspector-in-Charge (IIC) of a project is responsible for all inspection work on the project and for providing direction and guidance to the inspectors. The IIC monitors the various contractor activities, visits field operations, reviews reports and other records, and monitors the sampling and testing of materials.

The IIC is responsible for explaining to a property owner how the project will affect the owner's property. They should not discuss damages or indicate what settlement the property owner will receive; the right-of-way administrator provides this information. The IIC, however, is responsible for notifying the contractor not to trespass or do any work on private property unless the contractor has written permission from the property owner.

If the IIC finds that a structure or slope will extend beyond the right-of-way limit, they should report this to the ACE/ACM before construction is started. The IIC should also report any condition that will require more work or material than indicated in the contract.

The IIC also ensures that the contractor's maintenance and protection of traffic efforts are in compliance with the approved plans and directs appropriate changes when required. If a detour is utilized, the IIC is responsible for monitoring the detour conditions.

Section D: Organization of an Engineering District (Construction)

J. INSPECTOR

An Inspector is assigned to a construction project to assist the IIC in monitoring the contractor's operations. Inspectors have various levels of experience and carry titles and responsibilities accordingly.

Inspectors monitor the contractor's work for compliance with the contract, observe and document quality control testing, record information, and document quantities for completed work.

K. DISTRICT GEOTECHNICAL ENGINEER (DGE)

The District Geotechnical Engineer (DGE) is responsible for all work related to geology and associated engineering. They are responsible for oversight of geotechnical research and design for foundations, slopes, and other issues in the design phase. The DGE also assists with construction-related issues, such as foundations, sinkholes, slides, and unstable material.

L. WORK ORDER SPECIALIST

The District's Work Order Specialist will review work orders generated by the project inspection staff. These work orders are created when unexpected conditions arise during construction projects that require adjustments to the quantities or additional items not anticipated during the design process. In some cases, the Department may also require the contractor to perform the work using the force account procedure. Once generated by inspection staff and approved by the Work Order Specialist, they are then routed for approval.

M. LABOR COMPLIANCE/EQUAL EMPLOYMENT OPPORTUNITY (EEO) COORDINATOR

Department construction contracts contain two requirements relative to the contractor's workforce:

- Wage rates for various classifications of employees, including laborers, operators, carpenters, and flaggers.
- A commitment by the contractor to have a certain portion of the work performed by Disadvantaged Business Enterprises (DBE), Women's Business Enterprises (WBE), or Minority Business Enterprises (MBE).

The construction inspection staff is responsible for monitoring wage rates through interviews and payroll reviews. Contractor payrolls are also submitted to the District Labor Compliance Officer for review and approval. If the project staff identifies a problem, the District Labor Compliance Officer assists in its resolution.

At the time the contractor submits a bid, they commit to subcontracting a percentage of the work to DBE, WBE, or MBE firms. During construction, this percentage is closely monitored via payrolls and estimates. The District EEO Coordinator will periodically visit the project site for spot reviews or to assist the inspection staff in resolving issues.

N. FINALS UNIT

The Finals Unit conducts a final audit of the project records after the completion of construction. Duties for this unit vary by District. Staff is available to assist in setting up project records and may perform periodic audits to ensure conformance.

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SECTION 100: GENERAL POLICIES & PROVISIONS

GOALS

- Ensure compliance with PUB 408, PUB 2, PUB 72M, PUB 213, PUB 219M, and other policies and provisions.

SAFETY

- **Traffic Control:** Review devices and properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** A utility construction operation has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the contractor's supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Contractor Safety Plan:** Be familiar with the contractor's safety plan and ensure it is being followed by all personnel on the project, including all subcontractor personnel.
- **Mobile Device Usage:** Cell phones and tablets should only be used outside of active construction areas, away from moving equipment and traffic.

1. RELATIONS WITH PUBLIC UTILITY COMPANIES (SEC. 105)

This section addresses relations with public utilities that own utilities or structures in the right-of-way (ROW) or within the project boundaries.

☐ Review  Documentation Required

BEFORE UTILITY OPERATION CHECKLIST

☐ 	Task	Reference
☐	Review the utility clearance attached to the contract.	MCDocs
☐	Review plans, specifications, and contract requirements for incorporated utility work.	MCDocs

DURING UTILITY OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	If the contractor causes any damage to a utility, ensure they report immediately to the facility owner of any break or leak on its lines or any dent, gouge, groove, or other damage to such lines or their coating or cathodic protection made or discovered during construction.	

AFTER UTILITY OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Complete the Project Site Activity (PSA) Utilities Section when the utilities are scheduled to be working on the project. Maintain an accurate record of the work accomplished or document that no work was performed when scheduled. The completion of this Utilities Section shall be in sufficient detail to show the progress of work performed by the utility per PUB 2 Part B.1 standards.	
☐ 	If any damage to a utility occurs, ensure the Contractor and the Department submit an Alleged Violation Report (AVR) to the PA Public Utility Commission (PUC) through the One Call System, www.pa1call.org , within 10 business days in accordance with PUB 2 Part B.4.	

Utility Requirements

When the Department has been notified that a project is to start, the District staff makes arrangements for clearing ROW obstructions to avoid delays. Arrangements must also be made for the removal, resetting, construction, or reconstruction of public utilities or utility structures that may otherwise delay the contractor's operations. However, these Department arrangements do not relieve the contractor of responsibility for public and private structures on the project.

Upon execution of the contract, the contractor must notify the responsible officers of the utility about their utilities or structures in the ROW or within the project. Advance notice of the contractor's plan of operations must be given in time for the utility to plan and schedule necessary work prior to or concurrently with the contractor's operations. In the event that the contractor performs the utility work, the utility may arrange for a representative to be on-site.

The Inspector should review the Utility Clearance (Form D-419) with the Utility Clearance Assurance statement which is a Contract Attachment for the project that certifies that all written responses from all known utilities within the project limits have been received and written arrangements are on file.

The contractor is required to contact all utility representatives at least 15 calendar days prior to starting operations.

Form D-419 defines the following anticipated types of work for each utility company involved:

- **Prior:** The anticipated completion before the Notice to Proceed (NTP) is issued. The actual or anticipated completion date is shown.
- **Restrictive:** To be completed by the utility or a string of utilities before operating without restriction. The number of calendar days will start after the NTP is issued to the highway contractor, and the contractor notifies the utilities.
- **Concurrent:** Simultaneous with, but not restricting, operations. Number of calendar days required.
- **Coordinated:** Phasing with specific construction operations. Number of calendar days required after completion of a specific construction operation.
- **Not Affected:** Identifies the utility with facilities in the construction area that are not anticipated to be affected. Specific information may be provided by the utility.
- **Incorporated:** Utility relocation work to be incorporated into the prime highway construction contract.
- **Conditional Restrictions and Time Requirements:** Identify conditions affecting the utility's ability to perform a certain type of utility relocation work (i.e., certain times of the day, week, or year that a facility cannot be shut down, acquisition of ROW by the State, or demolition of the building).

The contractor should cooperate with utilities by arranging to perform contract work around such utilities or structures. If there is any possibility of interference or damage to such utilities or structures, the contractor should make arrangements before the work is started to ensure that all parties take precautionary measures. Prior to any excavation, the Inspector-in-Charge (IIC) should verify that the contractor has notified PA One Call (the entity that, by law, notifies all utilities with facilities in the construction area that construction is proceeding).

The contractor is required to notify the Department and report immediately to the facility owner any break or leak on its lines or any dent, gouge, groove, or other damage to such lines or their coating or cathodic protection made or discovered during construction. The contractor is also required to submit an AVR to the PA PUC through the One Call System, www.pa1call.org, within

Section 100: General Policies & Provisions

10 business days after previous damage is discovered or a utility line is struck or damaged on a Department construction project.

The Department is also required to submit an AVR to the PA PUC through the One Call System, www.pa1call.org, within 10 business days after a utility line is struck or damaged on a Department construction project. The One Call System website requires the establishment of an account in order to submit an AVR. Refer to PUB 2 Part B.4 for further information.

It is the responsibility of the contractor to be fully informed of the location of public utilities or structures that may affect the project. The Department will show any known public utilities or structures on the drawings, but the showing or leaving off of utilities or structures that are on, under, or over the project does not change the contractor's responsibility.

A construction inspector assigned by the IIC to a utility relocation is responsible for maintaining an accurate record in their PSA of the work accomplished or documenting that no work was performed when scheduled. The completion of this Utilities Section shall be in sufficient detail to show the progress of work performed by the utility.

This information must be reported daily in the PSA Utilities Section when the utilities are scheduled to be working on the project. Refer to PUB 2 Part B.1 for further details.

2. RELATIONS WITH RAILROADS (SEC. 105)

This section addresses relations with railroads within or adjacent to project limits of work.

☐ Review  Documentation Required

BEFORE RAILROAD OPERATION CHECKLIST

☐ 	Task	Reference
☐	Review contract special provisions regarding contractor railroad requirements.	
☐ 	Ensure the contractor has obtained all required approvals before entering the railroad to perform work.	

DURING RAILROAD OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Record the days and hours railroad flaggers are present on the project in the PSA.	
☐ 	Notify the IIC immediately if the contractor is performing work adjacent to a railroad without a railroad flagger.	

AFTER RAILROAD OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Document in the PSA if the contractor cannot perform work due to a lack of a flagger.	

Railroad Requirements

In general, construction projects involving railroads comprise one of two scenarios: those in which railroad personnel perform the work or those in which the contractor performs the work.

On projects where railroad personnel perform the work, the IIC should ensure that railroad work is completed so as not to delay the Department's contractor. The following information should be recorded on the daily PSA:

- Amount of railroad work by phase (such as track work and electrification) completed to date.
- Amount of labor and equipment used for each phase.
- Quantity of each material used for each phase.

Section 100: General Policies & Provisions

- Hours railroad personnel are present for flagging purposes.

When the Department receives a railroad invoice, it must be verified with the daily records before it can be processed for payment.

On projects where a contractor is performing the work, the IIC should be certain that a railroad inspector is always present and the number of hours railroad personnel are present for flagging purposes.

The IIC is also responsible for pursuing the PUC's order and being well acquainted with the portions of the order that directly relate to the railroad work performed before or during construction. The contractor must provide sufficient advance notice in writing to all affected railroad companies that highway construction work is proceeding at or near their facilities unless the PUC order directs the Department to do so.

All parties must ensure compliance with the PUC order and special provision requirements regarding notification to, and coordination and cooperation with, railroad officials. Further, all parties must adhere to all requirements pertaining to the work, safety, movement of trains, public and personal liability insurance, and any other related matters.

3. RELATIONS WITH THE FEDERAL HIGHWAY ADMINISTRATION (SEC. 105)

This section addresses relations with the Federal Highway Administration (FHWA).

FHWA Relations

On projects where federal funding is involved, the terms are contained in an agreement between the Department and the FHWA. If the federal government pays any portion of the project cost, federal laws pertaining to the project must be observed.

The Department is responsible for the engineering supervision and inspection of the project.

FHWA representatives make periodic inspections of construction projects. The inspector should answer any project-related questions.

4. LEGAL RELATIONS & RESPONSIBILITY TO THE PUBLIC (SEC. 107)

This section addresses legal relations and responsibility to the public as listed in PUB 408 Section 107, including the inspector's role in public interactions.

☐ Review

 Documentation Required

LEGAL RELATIONS & RESPONSIBILITY TO THE PUBLIC CHECKLIST

☐ 	Task	Reference
☐	Become familiar with the legal responsibilities associated with relations with the public outlined in PUB 408 Section 107.	
☐ 	Notify the IIC of any interactions with the public, including whether the complaint was resolved in the field or if the IIC needs to contact the customer for further action.	
☐ 	Ensure the contractor's bulletin board has all the required postings utilizing PUB 2 Part B.1 Bulletin Board Checklist.	

Legal & Public Relations

The construction and maintenance of roadways and bridges in Pennsylvania is publicly funded. PennDOT is responsible for planning and supervising the construction and maintenance of many of these roadways and bridges. An inspector, as a representative of the Department, has an obligation to see that all construction is properly performed to ensure that funds are spent correctly.

The inspector's relations with the public should always be professional and courteous. When asked a question to which a factual answer can be given, the inspector should do so politely. If the inspector is uncertain how to respond or if the question is about a specific action the Department may or may not take, the inspector should refrain from guessing or offering personal opinions. The inspector, however, can suggest the name of the person or agency to contact for the correct information or answer or indicate that they will discuss the question with their supervisor and that the supervisor will contact the individual. An inspector should never argue with the public at any time. Any complaints or criticisms should be relayed to the IIC for further action.

Inspectors and all PennDOT employees should:

- Comply with all federal, state, and local laws, ordinances, and regulations that have appropriate jurisdiction over the project and affect the conduct of work or that apply to employees on the project.
- Comply with all orders or decrees that have been or may be enacted by any legal bodies or tribunals having authority or jurisdiction over the work, material, employees, or contract.
- Verify that all required posting requirements have been placed on the project's contractor's bulletin board, utilizing the PUB 2 Part B.1 Bulletin Board Checklist.

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- Comply with applicable Federal, State, and local laws and regulations, provisions, and policies governing safety and health.

The contractor must follow PUB 408 Appendix C.DSP10. An inspector should inform the IIC of any potential discrimination or sexual harassment observed.

The inspector should notify the IIC when there is offensive language on hard hats, clothing, or bumper stickers.

The law may require that certain ordinances, regulations, orders, or decrees be posted.

It is also beneficial for the inspector to become familiar with more of the legal responsibilities associated with relations with the public. These are outlined in PUB 408 Section 107.

5. PROVISION FOR RIGHT-OF-WAY (SEC. 107)

This section addresses the provision for ROW, the area of land that the Department obtains and uses for highway purposes.

☐ Review  Documentation Required

BEFORE CONSTRUCTION OPERATION CHECKLIST

☐ 	Task	Reference
☐	Review ROW lines and locations on the contract plans and any authorizations to enter private property.	MCDocs
☐ 	Verify that the contractor has clearly demarcated the legal ROW and temporary construction easement(s) using stakes or fencing and will be working within the ROW.	
☐	Verify with the IIC that the adjacent property owners have been notified of the start of work.	

DURING CONSTRUCTION OPERATION CHECKLIST

☐ 	Task	Reference
☐	Ensure the contractor is not using private property to store materials, park vehicles, create access to the project, or for any other purposes.	
☐	Ensure the contractor is not restricting access to adjacent property owners beyond the Traffic Control Plan.	

AFTER CONSTRUCTION OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Document in the PSA if the contractor is working outside of the ROW or restricting adjacent property owner access.	

Right-of-Way Discussions

The Commonwealth acquires a ROW over private land through a formal legal process. The ROW required is based on a ROW plan prepared by the designer, a legal document signed by the Secretary of Transportation, giving the Department the right to use the land for highway purposes.

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As such, the ROW plan must be filed in the courthouse of the county in which the project is located.

The Department notifies property owners, in writing, of the need for their property. Real estate specialists contact the property owners to explain the impact, answer questions, and negotiate a settlement. If the acquisition of the property requires the owners to move, they may also be eligible for moving expenses and other costs.

One goal of the process is to negotiate an amicable settlement with the property owner. If this fails, the Department may use a process called condemnation to acquire the property. Condemnation provides a mechanism to expedite possession of the property for the Department. Under the condemnation process, the property owner is compensated according to certain laws and procedures. Payment to the property owners is based on the local market value of the property, based on an appraisal.

The Department is responsible for securing all necessary rights-of-way in advance of construction. Any exceptions are indicated in the proposal and contract and may include dates the contractor must wait for access to the property.

Obtaining rights-of-way or permission to do highway work on private land is the responsibility of the Department's ROW Unit.

The inspector's role is to verify the contractor is working within the allowed ROW areas as shown on the plans. These areas are shown as ROW, slope easements, and temporary construction easements on the plans. If the contractor is working outside these areas, the inspector should immediately notify the IIC. It is important to know where the legal ROW is located on the plans and that it is accurately reflected on the job site. Using property outside the legal ROW or temporary construction easement can result in legal ramifications between the property owner, contractor, and Department. Often, the contractor secures private property for staging equipment and materials in proximity to the project. The contractor should provide a copy of their agreement for the project.

6. INCIDENT MANAGEMENT PLAN

This section addresses incident management plans. These plans provide predetermined procedures, detours, and notifications that are implemented when incidents occur on the project that result in stoppages or significant delays to the flow of traffic.

☐ Review  Documentation Required

BEFORE CONSTRUCTION OPERATION CHECKLIST

☐ 	Task	Reference
☐	Review the contract's special provisions and learn what actions the contractor should undertake for a given anticipated incident.	MCDocs

DURING CONSTRUCTION OPERATION CHECKLIST

☐ 	Task	Reference
☐	Notify the IIC immediately in the event of an incident and ensure the contractor is implementing the correct response and notifying the appropriate parties involved, including calling 911 as needed.	
☐	Ensure the contractor is not restricting access to adjacent property owners beyond the Traffic Control Plan.	

AFTER CONSTRUCTION OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Document in the PSA any incidents that have occurred, including details of the incident and the contractor's response.	

Incident Management Plans Discussions

Construction projects frequently require lane restrictions or temporary traffic elimination during the construction season. The heavy traffic volumes on some projects often result in incidents that impede traffic flow or cause significant backups.

The Department requires an incident management plan during final design to address these incidents, including planned detours and response measures. The plan identifies actions or responsibilities to be assumed by the contractor as part of the contract (e.g., the availability of tow trucks to remove disabled vehicles).

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The plan is developed by the designer with input from the District Traffic Unit, state and local police, emergency response organizations, municipalities, schools, and local PennDOT Maintenance Districts.

The plan includes protocols and procedures, including contacts to be notified by the contractor or inspection staff. It also includes predetermined detours or alternate routing that is signed and can be quickly implemented.

The plan must be coordinated with municipalities so that local officials are informed and can assist accordingly. It is also necessary to meet with emergency services officials to identify emergency access points and other requirements.

The Department also confers with school districts to identify the impact of the project on school bus routes. The implementation of detours and alternate routes must be promptly conveyed to schools.

7. PROJECT DOCUMENTATION (SEC. 110 & 112)

This section provides a comprehensive guide on what to document in the Project Site Activity (PSA) report before, during, and after every construction operation. For operation-specific details, refer to the respective sections dedicated to each type of construction operation elsewhere in the manual.

This section also outlines the specific types of documents inspectors should review prior to the commencement of any operation.

In certain scenarios, safety concerns or time constraints may impede inspectors from directly inputting documentation into their PSA during ongoing operations. In such instances, it is strongly advised that inspectors employ alternative means, such as pen and paper, to record pertinent information. This approach ensures critical details are captured promptly, allowing for subsequent entry into the PSA when safety conditions permit or time becomes available.

☐ Review  Documentation Required

BEFORE OPERATION CHECKLIST

☐ 	Task	Reference
☐	Review applicable specifications, standards, special provisions, and drawings.	MCDocs
☐	Review applicable sections of the PUB 408 Highway Construction Specifications.	
☐	Review applicable sections of the PUB 2 Project Office Manual.	
☐	Review applicable sections of PUB 72M Roadway Construction Standards or PUB 219M Standards for Bridge Construction.	
☐ 	Review applicable PUB 213 Temporary Traffic Control Guidelines PATA figures or Traffic Control Plan. Verify traffic control devices are compliant with PATA figures or Traffic Control Plans.	MCDocs MCMPT
☐	Review the contractor's site safety plan.	PPCC
☐ 	Verify source of supplies are approved.	ECMS

DURING OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Record temperature and weather conditions.	

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☐		Task	Reference
☐		Record contractor information, including contractor company name, superintendent(s), labor, equipment, and hours worked.	
☐		Record contract item number and description.	
☐		Record the location of work, including the state route or road name, station from and to, and direction (LT/RT).	
☐		Take photos and attach pertinent ones to the PSA. Refer to and explain the photos in the comment section of the PSA.	
☐		Record details of the construction operation, including but not limited to material, contractor means and methods, and field discussions.	
☐		Record details of any utility operations as indicated under PUB 8 Section 100.2 Relations with Public Utility Companies .	
☐		Record the conditions of erosion and sediment (E&S) control devices one day per week and after a significant rainfall event.	VSIR

AFTER OPERATION CHECKLIST

☐		Task	Reference
☐		Record start and quit time.	
☐		Record commute and on-the-job mileage.	
☐		Verify that material certifications are submitted.	ECMS
☐		Complete measurements, perform needed calculations, and make payments.	
☐		Attach documents such as calculations, spreadsheets, and other pertinent source documents.	

Project Documentation Items

Maintaining accurate project records is essential to a well-managed project and one of the primary responsibilities of the inspector. To better understand how to keep thorough and accurate records, the following list defines the references and reports the inspector must be familiar with:

Contract Item Numbers: Item numbers identified in the contract correspond with sections of PUB 408. The Department uses eight-digit item numbers. The first digit in an Item Number identifies whether the item is standard, modified, or special. The next three digits call out the corresponding section of PUB 408.

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- A **standard** contract item example is 0xxx-xxxx, or, for example, (0203-0001). Follow the PUB 408 for this item under the 0203 section in this example.
- A **modified** contract item example is 4xxx-xxxx, or, for example, (4203-0001). Part of the PUB 408 details have been modified by the special provision associated with this item of work. The special provision explains what has been modified. When determining the scope of work and method of payment for this item, PUB 408 Section 203 and the contract item special provision must be used.
- A **specific structure** contract item example is 8xxx-xxxx, or, for example, (8120-0001). Refer to the structure special provision along with the component items associated with this structure as listed on the structure plans tabulations.
- A **project-specific specialty** contract item example is 9xxx-xxxx, or, for example, 9000-0001. Refer to the special provision in the contract explaining the material to be used, construction procedures, unit of measurement, and method of payment.

Engineering Construction Management System (ECMS): The computer system that manages all construction activities for every project in the state.

Items Quantity Report: Record of every PSA item documentation entry.

Mobile Construction (MC): The ability to perform project documentation utilizing an iPad.

PennDOT Project Collaboration Center (PPCC): A web-based project submittal, documentation, and file system that has dynamic multi-step/multi-reviewer workflows, submittal tracking, and document storage.

Project Site Activity (PSA): A daily report that is used to document any work performed, which includes contract items of work that is performed on the project, such as excavation or concrete placement, or document no work performed and the duties the inspector performed. The PSA should include references to any other source documents used during the work activity. The inspector's hours, weather temperature and conditions, commute and on-the-job mileage, the contractor's workforce and equipment, associated utility company work or no work as scheduled, and environmental construction mitigation work. The inspector adds general inspection duties or information witnessed during the inspection in the general notes section of the PSA. Remember to attach photos to document work performed during the day.

All payments are made on a PSA by contract item number at the appropriate plan location. Therefore, the PSA must be completed daily and submitted in ECMS.

Each contract item is measured and paid in the units shown in the item's PUB 408 Measurement and Payment Section of the specifications and the schedule of prices in the proposal unless otherwise specified. Refer to PUB 408 Section 109 for the description of measurement units. It is the inspector's responsibility to accurately inspect, measure, compute, document, and make payment for items of work performed under the contract. In determining quantities, the inspector may have to field measure portions of the work completed, count each item, or collect delivery tickets that show the amount of material delivered to the job site and used in completing the work. PUB 2 Part B.1 provides guidance on documentation.

No matter how a measurement is made, all information should be properly recorded on a PSA, stating the actual stations where the work was performed. This information may also be recorded in other project documentation as required, such as in a mobile construction app (eConcrete) when concrete has been placed. If there are any significant differences between plan quantity and actual quantity, an explanation should be documented, and references should be made to where the differences occurred.

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Photos: Photos of the operations should be taken during the inspection of the operations. They should consist of overall views of the operations and construction site, along with detailed photos of any problems, issues, or corrections that have been identified. A couple of pertinent photos should be attached to the PSA on a daily basis. All of the photos should be downloaded as directed by the IIC.

Publication 2 (PUB 2) Project Office Manual (POM): A compilation of Department policies and procedures relating to field administration and inspection of construction contracts, used as a reference for District staff in complying with these policies and procedures.

Publication 72M (PUB 72) Roadway Construction (RC) Standards: A compilation of guidelines and drawings for the construction of standard roadway items of work.

Publication 213 (PUB 213) Temporary Traffic Control Guidelines: A compilation of traffic control requirements for performing construction, maintenance, emergency, permit work, utility work, or any other type of work on or adjacent to highways. The Temporary Traffic Control schemes shown in this publication are consistent with the general provisions found in the most recent editions of Title 67 PA Code, Chapter 212, Official Traffic Control Devices and the MUTCD as issued by FHWA.

Publication 219M (PUB 219M) Standards for Bridge Construction: A compilation of guidelines and drawings for the construction of standard bridge items of work.

Publication 408 (PUB 408) Highway Construction Specifications: The Pennsylvania Department of Transportation's specifications book, provides specifications on material, equipment, and construction methods for virtually every type of roadway and bridge project undertaken in the Commonwealth.

Source Document: The original recording of the field information. Source documents consist of, but are not limited to, the following:

- PSAs
- MC apps such as the eConcrete app
- Drawings and plan sheets
- Delivery tickets or electronic tickets
- eCertifications
- Hand and Computer-Generated Forms (PPCC Project Files) and Tabulations
- Electronic Attachments

If information, data, quantity, measurements, or computations are recorded in more than one source document, all documents need to be cross-referenced in the source document, PSA, and retained in the electronic or paper files.

8. WORK AUTHORIZATIONS & WORK ORDERS (SEC. 110)

This section addresses work authorizations issued to the contractor by the Department's Representative to perform additional work and extra work that is not covered by plan tabulations. This authorization provides the contractor with permission to proceed with the work. A work order is then processed to make the changes in ECMS to allow payments to be made to the contractor.

☐ Review  Documentation Required

BEFORE DOCUMENTING ADDITIONAL & EXTRA WORK CHECKLIST

☐ 	Task	Reference
☐ 	Ensure there is an approved work authorization for additional or extra work and that the contractor has acknowledged the work authorization.	ECMS
☐ 	Utilize new item numbers for documentation of work.	ECMS MCFA
☐ 	Complete a daily record of force account work, including material, labor, and equipment if work is authorized on a force account basis. When the equipment is not performing work, it will be tracked as standby hours, and items not incorporated into the work will be tracked as consumables.	MCFA
☐ 	Track and document work that is in dispute using Record of Work.	ECMS
☐ 	Refer to PUB 408 Section 110 and PUB 2 Part B.3 for additional requirements.	MCFA

Work Authorizations & Work Order Discussions

The contractor receives a work authorization prior to performing any additional or extra work.

The Department's Representative, usually the IIC, generates a work authorization when it is determined that additional or extra work beyond plan tabulations is required to successfully complete the project. The work authorization is issued as outlined in PUB 408 Section 110. The work authorization is generated through ECMS. The Department's Representative must submit the electronic authorization to the contractor to confirm any oral authorization. Work performed without written authorization will be at the contractor's risk.

The work authorization specifies how the work will be paid. This is an indicator to the inspector that the work will be paid at a contract unit price or if the inspector will have to keep force account records for future payment of the work. It will also let the inspector know what item number to use to report the work on the PSA.

The work authorization is generated in ECMS, and the contractor needs to acknowledge the scope of work.

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Work authorizations are obtained for additional work and extra work as described in PUB 408 Section 110.

When this work is completed, a work order is generated through the ECMS to pay for the additional or extra work.

Accepted quantities for original contract work may vary from the estimated quantities shown in the schedule of prices or when the District Executive determines that work having no quantity or price in the contract is necessary to complete the project. A work order must be processed to either balance the original contract quantities or add additional or extra work to the contract. Rebates and penalties are processed as adjustments similar to asphalt and diesel fuel adjustments. Work orders are also needed to process payments resulting from negotiated dispute and claim settlements, court awards, and payments for approved value engineering. Work orders are processed through ECMS and submitted to the Department and FHWA for approval.

REFERENCES

[PUB 2](#) Project Office Manual

- Part B, Section 1 Documentation and Job Records
- Part B, Section 3 Work Orders
- Part B, Section 4 Health, Safety, and Environment

[PUB 72M](#) Roadway Construction Standards

[PUB 213](#) Temporary Traffic Control Guidelines

[PUB 219M](#) Standards for Bridge Construction

[PUB 408](#) Highway Construction Specifications

- Section 107 (Legal Relations and Responsibility to the Public)
- Section 109 (Measurement of Quantities)
- Section 110 (Payment)
- Section 203 (Class 1, Class 1A, Class 1B, and Class 1C Excavation)
- Appendix C (Designated Special Provisions (DSP) Contained in Publication 408/2020)

[VSIR User Guide](#)

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SECTION 200: EARTHWORK

GOALS

- Ensure the BEST possible riding surface is obtained for the motoring public.
- Ensure that an area of the embankment is free from defects and properly constructed.

EARTHWORK SAFETY

- **Traffic Control:** Review devices and properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** An earthwork operation has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the contractor's supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Nuclear Gauge:** Ensure the operator is wearing a badge and safely storing the source rod prior to moving.
- **Requirements:** Understand the OSHA requirements and the contractor's work plans for work in excavated areas.

1. CLEARING & GRUBBING (SEC. 201)

This section addresses clearing and grubbing, the first of several operations that are required to bring the construction site to subgrade. Clearing and grubbing is the satisfactory removal of materials that cannot be used in the work, although any topsoil removed as part of the clearing and grubbing must be stockpiled for use later in the project. These cleared materials may include trees, stumps, shrubs, topsoil, buildings, fences, and other obstacles interfering with the work.

Dispose of all materials in an approved waste area. Disposal of burnable material when open or free-standing burning is not permitted; burning may involve using incinerators if permitted within the Rules and Regulations of the Pennsylvania Department of Environmental Protection (PADEP). PUB 408 Section 213 covers the Temporary Project Air Pollution Control for the disposal of burnable spoils.

Work for clearing and grubbing may also include contract requirements for salvaging, temporarily storing, and delivering material to Department maintenance facilities.

☐ Review  Documentation Required

BEFORE CLEARING & GRUBBING OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review waste site approval documents, if applicable.	PPCC
☐	Verify that quality control (QC) plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	
☐	Review approved erosion and sediment (E&S) control plans and permits.	MCDocs
☐	Review contract right-of-way (ROW) plans and notes.	MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Review local ordinances in effect for operations such as noise, lighting, and burning. Discuss with the Inspector-in-Charge (IIC).	
☐ 	Verify density gauges are properly stored, prepared, and calibrated.	
☐ 	Confirm that the contractor has signed the National Pollutant Discharge Elimination System (NPDES) permit as the co-permittee prior to the start of work.	

DURING CLEARING & GRUBBING OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Track daily excavation of materials, the size of trucks, and load counts.	
☐		Ensure the top 8" of topsoil is properly stockpiled for later use on the project in accordance PUB 408 Section 801.	
☐		Record the location of waste and stockpiles used daily.	
☐		Verify the location or dispensation of salvaged material.	
☐		Document estimate of percentages complete.	
☐		Verify locations or dispensation of cut wood or logs.	
☐		Ensure that the contractor is following permits for E&S control daily.	E&S Permits
☐		Confirm permits are followed if materials are being burnt.	Air Quality Permits
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Ensure that all stumps and roots have been removed within 2 feet of the bottom of the subgrade.	

AFTER CLEARING & GRUBBING OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure all stockpiles are being treated in accordance with the approved E&S plans or best practices.	MCDocs
☐		Confirm the PennDOT Maintenance organization has been notified in accordance with the contract of the material salvaged and that the material has been properly stored on the project or delivered to the designated organization.	
☐		Verify that all clearing and grubbing have been completed prior to an embankment or subgrade construction.	

Material & Equipment

There is no material required for this operation.

There are various types of equipment used in clearing and grubbing, including chainsaws, log skidders, woodchippers, stump grinders, tree harvesters, feller-bunchers, incinerators, bulldozers, scrapers, excavators, and dump trucks.

Mechanical:				
60-Ton Dump Truck	Bulldozer	Excavator	Feller-Buncher	Hydroseeder
Incinerator	Log Skidder	Mulcher	Scraper	Stump Grinder
Tree Harvester	Tri-Axle Dump Truck	Woodchipper		
Hand Tools:				
Chainsaw				
Testing/Inspection:				
Measuring Wheel	Smart Level	Survey Rover	Surveying Rod	Total Station

Construction Methods

The process of clearing and grubbing involves cutting and removing trees (clearing) or other obstructions within the project site, stumps and brush, and organic material (grubbing). All stumps and roots within 2 feet of the bottom of the subgrade must be removed. Stumps in cut areas will be removed during excavation operations. Do not damage trees or other vegetation outside the ROW.

This work also includes the disposal of removed material, salvaging, storing, or delivering material, and chipping and stockpiling wood waste material in an approved waste area.

The contractor must obtain authorization and permits prior to any burning. The burning may be done by open burning or using devices such as an air curtain destructor. Burning is to be kept a minimum of 40 feet from existing vegetation. Organic material from the clearing and grubbing operation may not be used in any constructed fill areas within the project. The demolition of structures, such as buildings, garages, sheds, sign stones, fences, signs, markers, and guide rails, is also performed during this phase. The contract may require certain items, such as guide rails, signs, and posts, to be reserved for PennDOT reuse.

Measuring & Payment Methods

The clearing and grubbing activity is paid as a lump sum payment per PUB 408 Section 201.4. Progress payments of a lump sum percentage can be made throughout the operation until the full amount is paid, as agreed to by the Department IIC and the contractor.

Stockpiling the top 8 inches of topsoil is incidental to clearing and grubbing.

Temporary air pollution control for burning is paid as a negotiated price or as a force account; refer to PUB 408 Section 213.4.

2. DEMOLITION OF BUILDINGS & STRUCTURES (SEC. 202)

This section addresses the total or partial demolition of buildings and other structures (e.g., foundations, inlets, and utility holes), as well as the refinishing of party walls of buildings.

Total demolition includes the removal of the indicated buildings and structures wholly within the ROW.

Partial demolition involves the removal of the indicated buildings and structures partially located within the ROW.

Refinishing party walls involves the removal of indicated buildings and structures to the party wall that separates them from other buildings and structures outside of the ROW.

☐ Review  Documentation Required

BEFORE DEMOLITION OF BUILDINGS & STRUCTURES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review waste site approval documents, if applicable.	PPCC
☐	Review the contractor's approved demolition plans, if required.	PPCC
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐	Review all shoring plans for demolition, if required.	PPCC
☐	Review local ordinances in effect for operations such as noise, lighting, and burning. Discuss with the IIC.	
☐	Confirm that the Department has taken possession of the property and that it has been vacated. Discuss with the IIC.	

DURING DEMOLITION OF BUILDINGS & STRUCTURES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Record the location of waste and stockpiles daily. Private property may only be used with authorizations between the contractor and landowner.	
☐		Track daily excavation of materials, the size of trucks, and load counts.	
☐		Track utility disconnections and reconnections as per PUB 408 Section 110.03(d)4.	
☐		Verify the location or dispensation of salvaged material.	
☐		Record estimate of percentages complete daily or weekly.	
☐		Record party wall refinishing and quantity per PUB 408 Section 202.3.	
☐		Ensure that the contractor is following permits for E&S control daily.	E&S Permits
☐		Verify permits are followed if materials are being burnt.	Air Quality Permits
☐		Confirm that all cellar floors and other surface areas that have been demolished are backfilled as required, along with their location and quantities.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Verify that the contractor is following all safety requirements and that hazardous areas are being delineated so access is controlled.	
☐		Record that the contractor complied with the National Emission Standards for Asbestos as noted in the Federal Register, Volume 55, No. 224 .	

AFTER DEMOLITION OF BUILDINGS & STRUCTURES CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify area has been cleaned up as needed.	
☐		Confirm all disturbed areas have been treated with seeding and mulching if required.	

Material & Equipment

Depending on the type of demolition, the following materials may be required: cement, fine aggregate, lime, water, Class E-1 or E-2 emulsified asphalt, caulking compound, metal lathing mesh, roofing material, insulating board, and asphalt mastic.

For demolition activities, the contractor uses equipment such as excavators, bulldozers, front end loaders, dump trucks (both on-road and off-road), and cranes.

Mechanical:				
60-Ton Dump Truck	Bulldozer	Crane	Excavator	Front End Loader
Hydroseeder	Mulcher	Tri-Axle Dump Truck	Wheel Loader	
Testing/Inspection:				
Smart Level	Survey Rover	Surveying Rod	Total Station	

Construction Methods

Prior to commencing demolition operations, the contractor should meet with the proper authorities to ensure that all utility services are disconnected from the structure. For safety, the utilities must disconnect where the service line connects to the supply system. In most cases, an approved contractor's demolition plan is required before the start of demolition work.

In demolishing buildings or structures, the contractor should confine movements and operations to existing ROW limits. Depending on the size of the building, the contractor may use excavators or bulldozers; for large buildings, the contractor may use a crane and wrecking ball. However, this method is more hazardous and is not permitted next to a public thoroughfare or any other area where it will create a public hazard. For small structures, such as a single-family dwelling, the contractor may raze the building with a bulldozer and load the debris into dump trucks or roll-off containers with an excavator. The debris is hauled to an approved disposal site. For larger structures, when the building is torn down into smaller sections, temporary shoring of the remaining structure may be necessary for the safety of the workers. If required, the contractor must submit shoring plans for Department approval.

If only a portion of a building is slated for demolition, the contractor completes the work one floor at a time, beginning with the topmost floor. The contractor provides temporary shoring to help stabilize the portion of the building that is to remain. After completing the partial demolition, the contractor must take steps to temporarily weatherproof the exterior of the remaining structure.

All utility services to the remaining portion of the building must remain in service, using temporary connections during the demolition if necessary. The contractor is responsible for permanent utility reconnections to the remaining building.

For the sealing of water wells or springs, review and follow PUB 408 Section 214.

Once the demolition is complete, any disturbed subsurface areas are backfilled using accepted embankment construction methods. Any cellar floors or other solid surface areas should be

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rubblized to allow for proper drainage of subsurface water. The contractor removes any remaining debris from the site. If the plans or specifications do not identify the material to be saved as Department property, the material becomes the property of the contractor.

Afterward, the area is seeded and, if directed, mulched per PUB 408 Sections 804 and 805, respectively.

Measuring & Payment Methods

Demolition, disposal, and storage are paid as a lump sum per PUB 408 Section 202.

Refinishing party walls is paid per square foot. Progress payments of a percentage of the lump sum can be made throughout the operation until the full amount is paid.

The contractor is reimbursed for the cost of utility disconnections and reconnections as specified in PUB 408 Section 110.03(d)4. The treatment of disturbed areas is incidental to this work.

3. EXCAVATION (SEC. 203 & 204)

This section addresses the various classes of excavation used in construction projects. There are seven classes of excavation: Class 1, Class 1A, Class 1B, Class 1C, Class 2, Class 3, Class 4, and Cleaning Existing Ditches Excavation. It is necessary to understand the classification of excavation to ensure accurate documentation and payment.

Class 1 Excavation

Class 1 Excavation is a commonly performed excavation by the contractor on the project. Class 1 Excavation is a general-purpose excavation and is used in a variety of applications, as shown on the standard drawings, including:

The excavation of roadways, shoulders, ditches, drainage structures, stream channels, grade separation structures, retaining walls, wing walls, embankment benches, and the removal of existing pavements not being rehabilitated as indicated or directed.

- The excavation allows the placement of topsoil.
- The removal of unsuitable material encountered during Class 1 Excavation below the new subgrade with a bottom width of 8 feet or more.
- The removal and stockpiling of topsoil other than the first 8 inches.
- The removal of unforeseen slides and rock ledges.
- The removal of stone fences, piles of dirt and stones, boulders, and portions of structures above natural ground greater than the specified volume of $\frac{1}{2}$ cubic yard.

Class 1A Excavation

Class 1A Excavation is for removing unsuitable material below the existing subgrade when the bottom width of the excavation is less than 8 feet and saw cutting of existing pavement may also be indicated. Class 1A Excavation includes backfilling as specified in PUB 408 Section 206.

Class 1B Excavation

Class 1B Excavation is the removal of pavement to neat lines for roadway rehabilitation as indicated or directed. Specifically, the removal of existing pavement that will be replaced with new pavement. Includes full-depth saw cutting or milling of existing pavement to neat lines as directed.

Class 1C Excavation

Class 1C Excavation is for the excavation and undercutting of unsuitable material below an existing subgrade having a bottom width of 8 feet or more. This type of excavation would typically occur after the removal of an existing pavement structure, and the existing subgrade is planned to be reused. Class 1C Excavation includes backfilling as specified in PUB 408 Section 206.

Class 2 Excavation

Class 2 Excavation is used for inlets, outlets, parallel ditches, stream channels, structures not replaced and removed below grade, spillways, and half-circle pipes. Class 2 Excavation is only paid when the accompanying item of work (such as pipe or inlets) does not include excavation as incidental.

Class 3 Excavation

Class 3 Excavation is used for new grade separation and drainage structures: new retaining walls, abutments, piers, and wing walls.

Class 4 Excavation

Class 4 Excavation is used for pipe arches, standard end walls for pipes, and excavation deeper than the standard depth for underdrains, drain outlets, and subgrade drains. Class 4 Excavation is only paid when the accompanying item of work (such as pipe, underdrain, or inlets) does not include excavation as incidental.

Cleaning Existing Ditches Excavation

Cleaning Existing Ditches Excavation is the removal and disposal of all soil and organic material in existing ditches.

☐ Review  Documentation Required

BEFORE EXCAVATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review waste site approval documents, if applicable.	PPCC
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Review PUB 72M RC Standards 10M and 11M.	
☐	Review approved cross section and soil profiles.	MCDocs
☐	Review the department-accepted blasting plan and blasting safety plan.	
☐	Confirm that the contractor has signed the NPDES permit as the co-permittee prior to the start of work.	

DURING EXCAVATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Record the location of the material excavated and what the contractor is doing with the excavation. Excavation must be considered available for embankment when suitable.	
☐ 	Track daily excavation of materials, the size of trucks, and load counts.	

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☐		Task	Reference
☐		Ensure the contractor is stockpiling topsoil as indicated or directed.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Collect and deliver any seismic records and documentation of blast shots to the project field office.	
☐		Ensure that the contractor is following permits for E&S control daily.	E&S Permits
☐		Ensure that wetlands are protected by orange construction fencing when applicable.	E&S Permits
☐		Record that the contractor has all required agreements for borrow areas.	
☐		Verify that the contractor is following all safety requirements and that hazardous areas are being delineated so access is controlled.	
☐		Record that the contractor complied with the National Emission Standards for Asbestos as noted in the Federal Register, Volume 55, No. 224 .	
☐		Record any changes in the excavation that do not appear as indicated on the soil profiles and cross sections.	

AFTER EXCAVATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the area has been cleaned up as needed.	
☐		Ensure all disturbed areas have been treated with seeding and mulching if required.	

Material & Equipment

Materials used in blasting operations include stemming material (aggregate), which is used to backfill blast holes after placement of the explosives, and all explosive materials (i.e., initiators, blasting caps, detonation cords, delay/timing devices, and all other materials and devices necessary to perform the work).

For general excavation operations, the contractor uses a variety of equipment, including bulldozers, backhoes, scrapers, excavators, and front end loaders, to excavate and load material. Equipment used in stream channels and other wet excavation also includes water pumps (of

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various sizes and types), cranes, equipment for placing sheet piling (for coffer dams as necessary), dragline excavators, and clamshell buckets. Dump trucks, scrapers, and 60-ton dump trucks may be used to transport excavated material. Vibratory steel wheel rollers and sheepfoot rollers are needed for embankment construction.

For blasting operations, the contractor needs equipment such as a drill rig, an explosive mix truck, and a magazine truck.

Mechanical:				
60-Ton Dump Truck	Backhoe	Bulldozer	Clamshell Bucket	Crane
Dragline Excavator	Drill Rig	Excavator	Explosive Mix Truck	Front End Loader
Hydroseeder	Magazine Truck	Mulcher	Scraper	Sheet Pile Driver
Sheepfoot Roller	Tri-Axle Dump Truck	Vibratory Steel Wheel Roller	Water Pump	Wheel Loader
Testing/Inspection:				
Smart Level	Survey Rover	Surveying Rod	Total Station	

Construction Methods

Prior to the excavation, the contractor must complete the clearing and grubbing and install all required E&S controls. The inspector will review and document that the E&S controls and Best Management Practices (BMPs) are in place and functional and that all required permits, easements, and agreements (e.g., borrow or waste agreements) have been submitted, approved, and are on file in the project office. In addition, all plans and specifications for this work must be approved and available.

The inspector must understand that excavation trenches for pipes and end walls can be extremely dangerous due to potential collapse or cave-in. Proper layback, bracing, and/or shoring are critical, and strict adherence to OSHA regulations is imperative.

The limits of Class 1, 2, 3, and 4 Excavations are shown in PUB 72M RC Standards 10M and 11M. Excavation limits for pipe trenches should maintain the least amount of disturbance possible to trench walls and foundations. Excavation payment limits are in PUB 72M RC Standard 30M. Standing water should be removed by pumping or draining. Flowing water must be controlled or diverted in whatever way possible to minimize erosion and saturation of the pipe trench.

When excavation begins, the inspector ensures that the control points for alignment and elevation have been established. During excavation, the width, depth, and grade of the excavation should be verified by the inspector using the control points and compared with contract drawings and requirements. Accurate measurements and records must be kept by the inspector to ensure proper documentation and payments.

Excavated material should be placed or stockpiled by the contractor a safe distance from the edge of the open excavation, as determined by the Competent Person (OSHA 1926 Subpart P,

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1926.650), so that material does not fall or slide back into the excavated area and so that the stockpiled material does not cause loading on the open excavation cut slope. This minimizes the potential for re-excavation and protects workers in the trench. The inspector should stop any unsafe operations and immediately notify the IIC.

The contractor will excavate existing material to the lines and elevations on the contract plans and cross sections. The contractor and inspector continually monitor these lines and elevations to ensure adherence to the plans. An acceptable plan for monitoring the grade must be in place prior to excavation.

Control of Slopes

The completed excavated slopes should have an even appearance. The contractor will use various pieces of equipment, such as excavators or bulldozers, during the cut excavation. The contractor will check the side slopes with survey equipment or Global Positioning System (GPS) equipment to confirm the slopes match the drawings and cross sections. The inspector's task is to witness the contractor's checks and confirm that the work follows the grading plan.

The contractor should follow the plans for rounding at the top of the slope for aesthetics and to prevent material at the top of the slope from eroding and falling down the slope. Unless noted differently on the plans, areas of solid, competent rock cuts are not typically rounded.

The inspector should compare the material being excavated with the material represented in the subsurface soil profiles and cross sections, geotechnical reports, and contract drawings. If the inspector believes the material deviates from what is indicated in the contract documents, inform the IIC, and the Assistant Construction Engineer/Manager (ACE/ACM) and District Geotechnical Engineer (DGE) should be consulted.

Once the contractor completes the excavation to subgrade elevations as indicated on the plans and cross sections, proof rolling must occur. Proof rolling results may indicate the need to undercut or excavate below the indicated subgrade grading point if unsuitable soil, as defined in PUB 408 Section 206.2, is encountered within the proposed subgrade area. The inspector should contact the IIC if these conditions exist. PUB 408 Section 208.3 provides guidance for proof rolling subgrades in cuts and for stabilization and undercutting unsatisfactory subgrades. The area to be undercut should be over-excavated to a width and depth sufficient to remove the unsuitable material. Excavate the undercut area to allow the subgrade to properly drain. Placing geotextile at the base of the undercut provides a separator layer between the fill material and the undercut subgrade material. If the undercut has not been planned in the construction documents, the IIC should consult with the DGE. Coal exposed on the cut slopes will typically have treatment details included in the plans; if such details are not included in the plans, consult with the IIC and DGE. Additional information on Acid Producing Rock (e.g., coal) is available in PUB 293 Chapter 10.

To prevent erosion of bare slopes, seeding and mulching must be completed promptly. Slopes should be seeded and mulched as soon as possible, adhering to the E&S control plan and ideally as they are constructed. Additional work, such as the installation of erosion matting, contour ditching, or additional E&S control methods, may be needed in problem areas.

Cuts should be full width, with no undermining of slopes. Upon completion of the excavation, the work area is cleaned up and restored in accordance with contract requirements.

Stream Channel & Other Wet Excavation

The ACE or IIC inspects new drainage channels that have a bottom width of 8 feet or more. The contractor informs the ACE or the IIC in writing when the excavation has been completed according to the drawings and other requirements. If the channel is satisfactory, it is cross sectioned, with the measurements and location used as the basis for current and final payments

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for this portion of the work. If the ACE or IIC orders, in writing, additional work on the channel, the additional excavation is measured and paid separately.

Occasionally, a large amount of water flows into an excavation from the adjacent ground. The IIC should evaluate the situation to determine if there is a way of cutting off or diverting the water flow to keep the excavated material as dry as possible. Unless work to be done in a stream channel is shown on the contract drawings, the contractor cannot waste or deposit any material or perform any work in the stream without a permit from PADEP.

The contractor is not permitted to ford streams with equipment without constructing causeways or temporary stream crossings. These temporary encroachments require a permit, normally included as part of the contract or obtained by the contractor through the Pennsylvania Association of Conservation Districts (PACD) or PADEP, before they can be constructed.

In performing excavation in a stream channel, the contractor should use a hydraulic excavator, backhoe, clam bucket, or other equipment capable of working outside the existing channel. If excavation will affect the aquatic life in the stream, the proper agencies, such as but not limited to the Pennsylvania Fish and Boat Commission, should be contacted to allow them to analyze the impact on the aquatic life and provide an appropriate course of action. The inspector should check plans and contract documents to ensure areas adjacent to the stream are not wetlands, which require special effort.

The inspector should ensure that the contractor does not pollute any water sources with fuels, oils, bitumen, or other contaminants and that these materials are located in such a manner that accidental discharges or runoff will not cause water pollution. Care should also be taken when locating job site lavatories to ensure the protection of nearby waterways.

The contractor must install and maintain all required E&S control measures following approved E&S control plans and construct any needed causeways or temporary stream crossings. The contractor cannot ford or encroach upon the stream until these measures are in place. These temporary encroachments require a permit before construction. Any changes to the plans for crossings, diversions, or causeways require a permit amendment.

The contractor first constructs cofferdams or temporary stream diversions. Lines and dimensions are then excavated as shown on the contract drawings. If excavated material is to be used for the embankment and is too wet for that purpose, the material is stockpiled and dried to a usable moisture content before use. The material should be tested using the proctor test to determine the optimum moisture content and the maximum dry density to determine the suitability of the fill material and if drying or wetting is required. Information (maximum dry density, optimum moisture content) about the soil is also needed for nuclear gauge testing.

Ditch & Drainage Excavation

Ditches parallel to an embankment should be dug prior to embankment construction. Ditches parallel to the proposed roadway should be shaped as the cut is made. In either case, the drainage ditches will permit rainwater and groundwater to run off and prevent softening of the soil under the foundation.

Parallel ditches in a cut section should be constructed as excavation proceeds. All ditches are graded and maintained to provide positive drainage. Permanent ditches are constructed to the lines and elevations shown on the plans and cross sections and are lined per contract documents, if applicable.

Upon completion of the excavation, drainage is maintained to minimize future problems, and the work area is restored according to the contract documents.

Permanent ditches and drainage channels are shown on contract as-built plans and cross sections.

Excavation of Private Driveways

The Department must have acquired permanent or temporary ROW from the driveway owner before excavation begins. Working on private property without a permanent or temporary ROW exposes the Department to litigation and financial judgments. Information on work to be performed on driveways is contained in the project plans. If, for some reason, the work is not performed, changes are to be shown on the as-built construction drawings, and the IIC should consult with the ROW Department Manager.

Blasting for Rock-cut Slope Excavation

Blasting is used in rock excavations where mechanical excavation methods cannot penetrate the material efficiently or produce a uniform excavated surface at the specified slope angle. PUB 408 Section 207 covers the use of blasting for rock-cut slope excavation.

When blasting is permitted, the contractor will drill a series of holes in a specified pattern dictated by the type and characteristics of the rock formation. Explosives will be set into the bottom of the holes, with the remainder of the hole backfilled with stemming material (aggregate) to prevent "over-blasting." Blasting is performed to produce manageable rock pieces that allow excavation with conventional equipment. The larger pieces of blasted rock debris are often broken down further using a hydraulic hoe ram to increase the mobility of the debris. In some contracts, mechanical excavation using equipment such as hoe rams, dozers with rippers, or hydraulic excavators with rock teeth may be dictated as part of the contract conditions because of the sensitivity of the site to the vibration resulting from blasting. Some projects prohibit blasting, as is the case for some structure foundations. If blasting is prohibited, the structure plans and/or project special provisions will state that blasting is prohibited.

The two types of blasting used in combination with one another are termed Controlled Blasting and Production Blasting.

- 1) **Controlled Blasting:** Controlled blasting involves the use of explosives carefully spaced with aligned holes to produce a final uniform surface along a slope. There are two methods of controlled blasting: pre-split blasting and trim blasting. The major difference between the two is the thickness of the overburden.
 - a. **Pre-split Blasting:** Pre-split blasting is a controlled blasting method used to split the area to be excavated from the final slope face. In pre-split blasting, the contractor will drill a series of aligned holes directly along the final slope face to be excavated, as indicated on the cross sections. Presplit blasting uses reduced hole spacing, diameter, and explosive charges. The initiation of blasting in the pre-split blast holes precedes the initiation of the adjacent production blast hole explosives by a delay. This process of delay prevents energy from the production blast from propagating into the final cut face.
 - b. **Trim Blasting:** Trim blasting is a controlled blasting method that cleanly shears the rock face and is used when there is insufficient overburden, defined as 15 feet or less, measured from the final cross sectional slope face to the existing open slope face.
- 2) **Production Blasting:** Production blasting is used to fragment the rock outside the desired final cut face so the resulting overburden can be excavated. Production blast holes are drilled in a pattern throughout the main excavation area adjacent to the controlled blast row. Production blast holes are detonated in a controlled delay sequence toward an open face or relief produced by blast holes firing on an earlier delay.

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The inspector should review the contractor's Accepted Blasting Plan on file to ensure the contractor has received approval from PADEP according to Pennsylvania Code, Title 25, Environmental Resources, Article IV, Chapter 77, Chapter 210, Chapter 211, and all local requirements. All blasting operations must be performed by a Blaster licensed in the Commonwealth of Pennsylvania, and a copy of the license should be submitted to the PennDOT project office. Check to see that the licensed Blaster has demonstrated a minimum of three years of experience. These records should be submitted to the PennDOT project office at least 21 days prior to blasting. Refer to PUB 408 Section 207.3 for details of required contractor actions before and after blasting.

Measuring & Payment Methods

Measurement and payment are in accordance with PUB 408 Section 203.4.

Temporary payments may be made for all classes of excavation using cubic yard payments based on assumed truck volume and truckload count; temporary payments are subject to verification by final volume derived from in-place measurements. Temporary truckload count payments are usually limited to larger excavations. The cubic yards per truck are derived from the measured dimensions of the truck bed and applying an appropriate swell reduction factor.

Final excavation quantities are paid as an in-place volume before removal or, in embankment cases, for foreign borrow material after placement. The contractor and IIC should agree on a load factor for each type of truck hauling excavated material. A good estimating tool is to use 8 cubic yards of excavation per tandem axle truckload and 10 cubic yards of excavation per tri-axle load. Larger trucks will need measuring to agree on estimated load volumes. Newer 60-ton dump trucks may have load cells that measure the weight of hauled material. This weight measurement can help estimate the amount of material excavated.

Class 1, Class 1A, Class 1B, & Class 1C Excavation

Excavation is calculated and paid by the cubic yard. Excavation payable quantities completed within established slope lines may be paid by the contractor and the Department Representative (IIC) accepting the contract plan quantities, or the excavation may be measured using methods prescribed in PUB 408 Section 203.4.

Class 2, Class 3, & Class 4 Excavation

Excavation is calculated and paid by cubic yard measured, using the methods specified in PUB 408 Section 203.4 for the Excavation Class indicated.

Cleaning of Existing Ditches Excavation

Excavation is paid for by the linear foot.

Production Blasting

All material, explosives, labor, tools, traffic control, and equipment are incidental to the Excavation Class or borrow specified and will not be paid separately.

Controlled Blasting

Pre-split blasting and trim blasting are paid by the linear foot and based on acceptable blast hole depth for holes drilled within tolerance.

4. EMBANKMENT PLACEMENT (SEC. 206)

This section addresses elevated pavements, which are supported by either an embankment or a bridge structure. While bridges are needed to span a ravine or water crossing, elevated roadway profiles call for the construction of an embankment, as it is the most practical and cost-effective method of supporting a roadway structure.

Structure backfilling is embankment construction adjacent to or over a structure as specified in PUB 408 Sections 205, 206, 1001.3, the standard drawings, and PUB 72M RC Standard 12M. Special attention needs to be paid to monitoring the cure time for the cast-in-place structures prior to beginning to backfill. When backfilling structures, maintain symmetrical backfill loading on both sides of the structure. PUB 72M RC Standard 12M (sheet 2 of 2, note number 2) and PUB 408 Section 205 provide specifications for the Selected Borrow Excavation for Structure Backfilling. The placement procedure for structure backfill material is specified in PUB 408 Section 206.3. Structure backfill is considered Granular Material Type 2 in Section 206.

When the roadway profile does not call for elevated construction, the pavement will be constructed on a newly built subgrade in an excavation cut or on an existing subgrade.

Embankments are the foundations for the pavements constructed above the existing ground level. An embankment is designed and constructed as the sub-pavement support. It may consist of granular soils, rock, shale, granular mortar, or random material, as further defined in PUB 408 Section 206.2. Specialty materials, such as lightweight products (e.g., geofoam, foamed glass aggregates), may also be used in constructing the embankment to satisfy geotechnical stability needs. The embankment material preferably comes from suitable material excavated within the project limits; otherwise, suitable material may need to be hauled to the project site.

The quality of a roadway pavement structure is only as good as its embankment foundation; therefore, attention to detail and quality placement and compaction are imperative during the construction of the embankment. A poorly constructed embankment is likely to settle or fail. As a result, the material above the embankment but under the pavement and the overlying pavement itself will settle or fail, creating an uneven, rough-riding surface, necessitating premature rehabilitation or replacement.

A well-constructed embankment will provide a consistent pavement foundation and a long-lasting, smooth-riding highway requiring minimum maintenance during its design life cycle. When constructing an embankment, the construction should begin on firm and stable ground. A project may specify that the ground the embankment is to be built on be treated by proof rolling, have chemical additives added such as lime, be subjected to a surcharge, have unsuitable material removed and replaced with suitable material, or otherwise be monitored for settlement to make it suitable for construction.

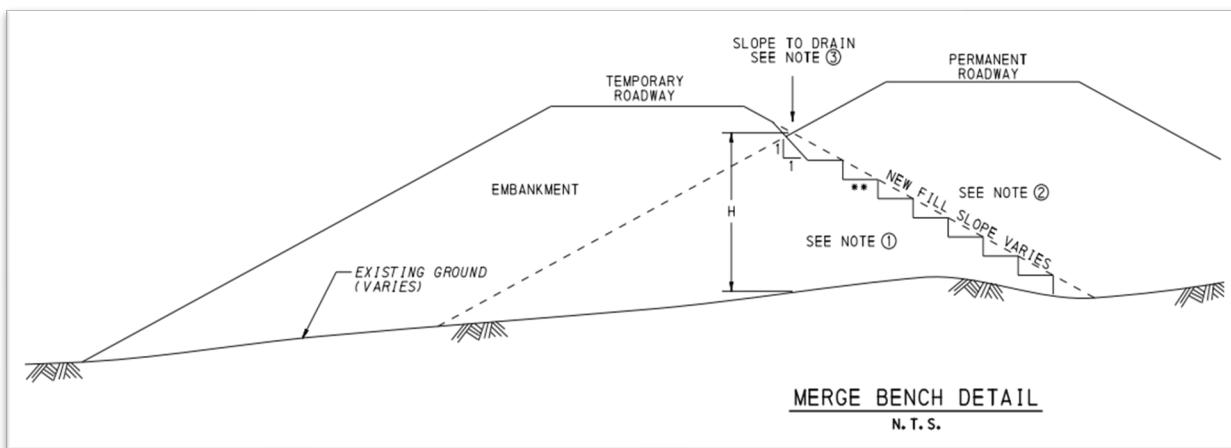
To ensure a well-constructed embankment, the inspector must be thoroughly familiar with how the embankment is to be constructed. This includes familiarity with the content of the specifications, contract special provisions, contract drawings, and cross sections. Refer to PUB 408 Section 206 for proper placement and compaction of the embankment and fill.

Benching

Constructing an embankment against an existing slope (Merge Benching) in a construction area should include benches cut into the existing slope to prevent the embankment from slipping along the existing slope profile. The importance of the benching cannot be overstated. Details necessary to construct the benches are depicted on the drawings, including typical and cross sections. If the details shown seem insufficient, not applicable, or inadequate, notify the IIC immediately.

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Additional benching, sliver fill, and toe key details are available in a future edition of PUB 293. Note that the information shown on the approved contract drawings will take precedence over the embankment widening guidance in PUB 293.



Removal of any existing vegetation and topsoil is a crucial detail to the proper construction of any embankment, especially in areas requiring benching (refer to Section 1 in this document and PUB 408 Section 201). The dimensions and slope of the benches are detailed on the construction plans and cross sections, and construction should adhere to these requirements. The wider the benches, the more stable they will be, as benches provide the means for the embankment to lock into the original ground and reduce the potential of slipping or sliding along the interface. Existing ground geometry often dictates the available bench sizes, but benches should be at least 8 feet wide to permit construction equipment proper access.

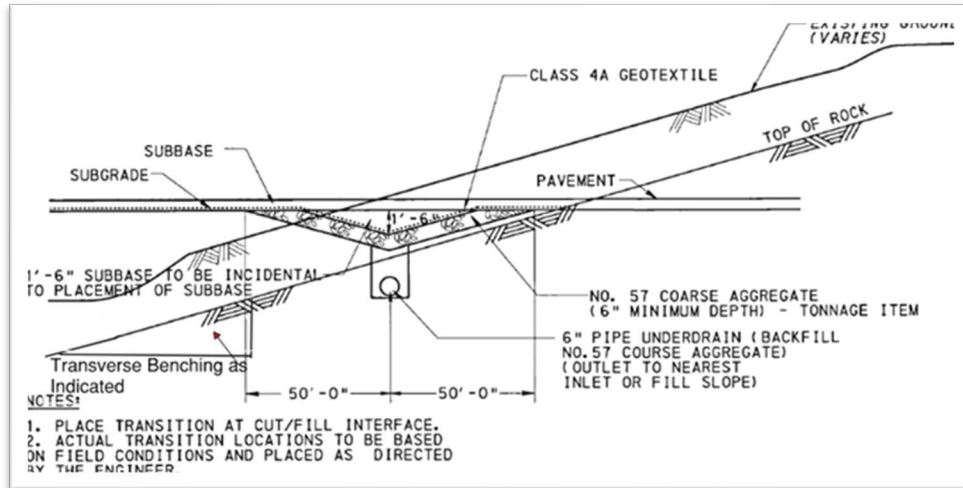
Benches should be sloped to drain water, and an outlet for water must be provided. Benches often have a lateral drain along the cut side of the bench. Trapped water is very detrimental to stability, especially in an area that has soil properties subject to sliding. Whatever method is in the approved design, the objective is to drain the water before its presence reduces the physical strength of the benching base and embankment soils, which leads to an expensive and potentially dangerous situation.

Suitable material, as defined by PUB 408 Section 206.2, excavated from benching, should be incorporated into the embankment. Accurate records should be kept of the location and dimensions of the benches.

Lateral Benches

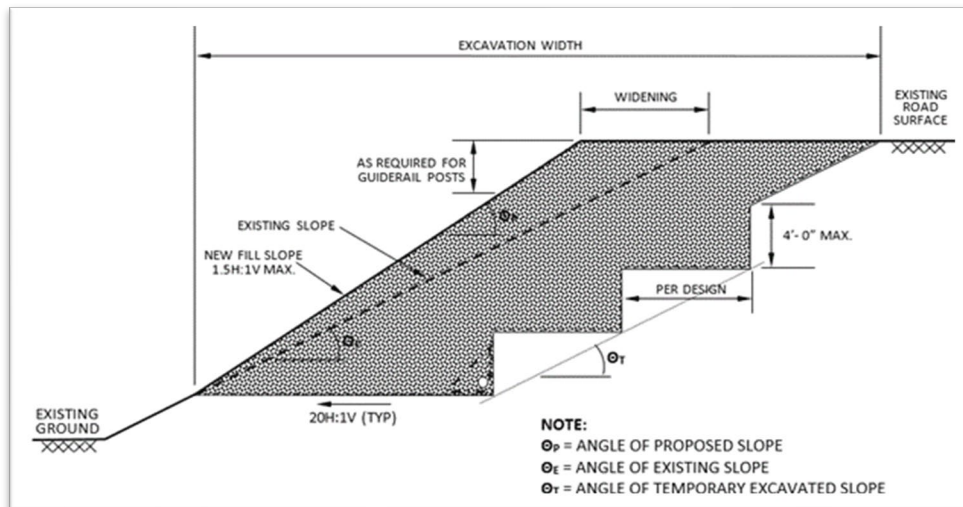
A lateral bench is an embankment that fills a depression or low area along the profile grade, and then the ends of the embankment will meet the original ground at some angle at or near perpendicular to the proposed roadway alignment. This angle is known as the transverse or lateral angle. Where the newly constructed embankment meets the existing grade longitudinally, a perpendicular bench into the existing grade is needed to properly tie the new fill into the existing ground. Since groundwater may be present in the existing grade at this lateral bench interface, these lateral ties in benches require transverse drains to be installed. A transition detail should be included in the contract plans.

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Sliver Fills

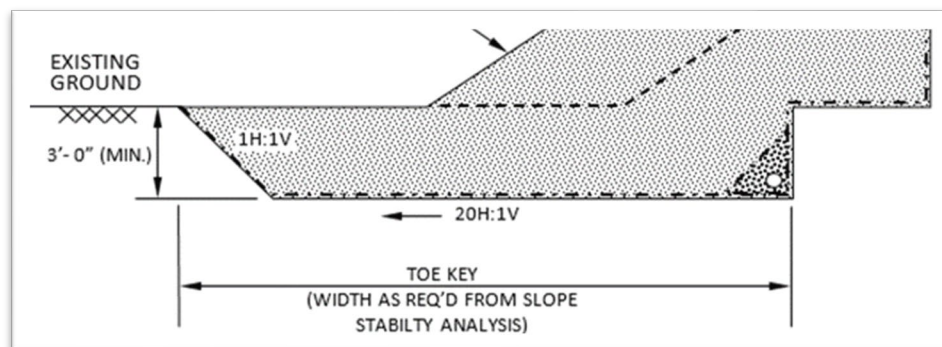
Sliver fills are constructed when a portion of the highway is to be constructed, but the existing embankment or cut area is not wide enough to support the widened highway structure's lateral dimension. Sliver fills, by their nature, are relatively narrow. Attention to detail is paramount when constructing sliver fills to ensure that benching is properly constructed, quality material is placed, and the compaction must meet the acceptance criteria specified in PUB 408 Section 206. Drainage at the interface of the existing ground and the embankment material is crucial to the stability of the finished product.



Toe Keys

Toe keys are benches cut into the original ground at the outside edge of the base of the embankment. Toe keys, as with all benches, are constructed to help stabilize and lock in embankments to prevent movement or failure of the finished roadway. Toe key dimensions should also be detailed in the construction drawings and cross sections. Toe benches are frequently constructed with rock material if the area of the key is expected to become wet.

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Frozen Materials

Frozen material should not be placed on an embankment. It is impossible to fully compact frozen material. Frozen material incorporated in the embankment will thaw, resulting in a wet and unstable embankment.

Specifications prohibit the placement of frozen material in an embankment or the placement of embankment material on frozen ground or a frozen layer of fill. Should a layer of fill or the natural ground be frozen, the contractor may opt to push the frozen material out of the work area to continue embankment placement.

☐ Review Documentation Required

BEFORE EMBANKMENT OPERATION CHECKLIST

☐	Task	Reference
☐	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐	Review approved Compaction Control QC Plan (Form CS-206), if applicable.	
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Review PUB 72M RC Standards 10M and 11M.	
☐	Review approved cross section and soil profiles.	MCDocs

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☐		Task	Reference
☐		Review the department-accepted blasting plan and blasting safety plan.	PPCC
☐		Confirm that the contractor has signed the NPDES permit as the co-permittee prior to the start of work.	

DURING EMBANKMENT OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Record load counts, if needed, of embankment material.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Verify that the contractor is following permits for E&S control daily and that a signed copy of the NPDES permit is onsite.	E&S Permits
☐		Confirm that wetlands are protected by orange construction fencing when applicable.	E&S Permits
☐		Record all proof rolling results and locations completed prior to embankment construction.	
☐		Record that the contractor has all required agreements for borrow areas.	
☐		Ensure that the contractor is following all safety requirements and that hazardous areas are being delineated so access is controlled.	
☐		Verify that survey controls are in place and work is following the stakeout plan or that a GPS grading plan is in use.	
☐		Record any proctor reports and moisture tests.	
☐		Confirm if the material compaction will be monitored using nuclear gauge testing or non-movement.	
☐		Accept embankment material after compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	

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☐		Task	Reference
☐		Ensure any oversized rock pieces have been segregated to the outside of the embankment and broken into lift-size pieces.	
☐		Verify that embankment lifts are being placed full width, benching has been done where indicated, and any drainage items used and their locations.	
☐		Confirm necessary undercut locations, measurements, and backfill details.	
☐		Ensure that the contractor has rolled the last lift of the day to seal the embankment to prevent water infiltration.	
☐		Verify the last lift of the embankment was constructed according to the specification, including granular material and geotextile if specified.	

AFTER EMBANKMENT OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document that the area has been cleaned up, as needed.	
☐		Document that all disturbed areas have been treated with seeding and mulching if required.	

Material & Equipment

Materials used for embankment construction may include rock, shale, soil, random material, or granular material defined by PUB 408 Section 206.2. All materials for the work must be acceptable per the compaction requirements for the applicable material type in PUB 408 Section 206.

If the material used is to be excavated from the project, it must be approved by the IIC per PUB 75 Section B.4.

Borrow excavation may be necessary if the on-site project quantity is insufficient to complete embankment construction or if the staging of the phases is such that on-site excavation is unavailable at the time it is needed for embankment construction.

Equipment typically used for this work includes excavators, bulldozers, scrapers, rollers (smooth drum and sheepsfoot types, as specified in PUB 408 Section 108.05), dump trucks, and 60-ton dump trucks. Equipment selected for compaction of a soil type is not readily interchangeable with the equipment selected for another soil type. Typically, a vibratory steel wheel roller is used for cohesionless soils, and a sheepsfoot roller is used for clay soils; sheepsfoot). The contractor also

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needs compaction testing equipment for materials classified as "Soil" and "Type 1, Granular Material", as further detailed in the Compaction Section.

Mechanical:				
60-Ton Dump Truck	Bulldozer	Excavator	Hydroseeder	Mulcher
Scraper	Sheepsfoot Roller	Tri-Axle Dump Truck	Vibratory Steel Wheel Roller	Wheel Loader
Testing/Inspection:				
Nuclear Gauge	Smart Level	Survey Rover	Surveying Rod	Total Station

Construction Methods

Constructing new stable embankments is the responsibility of the contractor, and the construction must be witnessed and verified by the PennDOT inspector. All required permits must be approved and on file before construction activities begin. In addition, all required E&S control measures should be in place, inspected, and functional. The embankment construction begins with preparing the foundation, as discussed in Section 200.1 of this document, and as specified in PUB 408 Section 201.

Contract specifications will detail the need for undercutting or proof rolling of the foundation below the embankment, and the compaction requirements are in PUB 408 Sections 206.3 and 208 and Section 200.7 of this document. The contractor is required to prepare and submit for approval a compaction control QC plan before embankment construction, refer to PUB 408 Section 206.3. If moisture, density, and acceptance testing of the embankment material are required, the inspector should be familiar with those requirements, as stated in PUB 408 Section 206.3. The inspector must be familiar with the contractor's QC plan and all the contract specifications and details for the embankment construction.

Before placing material, the contractor's survey crew must establish the limits of the proposed embankment and set slope stakes as the embankment construction proceeds. A contractor may opt to use GPS grading technology for the embankment construction; with GPS technology, grading stakes will not be set, but the inspector should have a GPS rover available to use so construction progress and limits can be monitored. The contractor is responsible for damage to private property caused by any work outside the ROW limits. Any work outside of ROW is not authorized by the Department.

Areas of water, swamp, or saturated unstable material, construct the embankment or fill with rock to the indicated elevations or as directed; refer to PUB 408 Section 206.3. Generally, a substantial layer(s) of rock underlain by a separation or reinforcement geotextile is used to bridge these areas and provide a uniform and stable base upon which to construct the embankment. Undercutting may be directed for the removal of unsuitable material. The ACE should coordinate with the DGE and determine the quantity of this unsuitable material to be removed and disposed of. In some situations, undercutting is not acceptable, and IIC, ACE, or DGE may permit the contractor to end dump rock to an elevation that establishes a solid working platform.

The contractor must employ methods that promote free draining and prevent groundwater from infiltrating the embankment, causing a condition that may produce an unstable embankment or a

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sliding of the embankment's foundation. Should springs or water seeps appear in the foundation area before the beginning of embankment placement and the contract documents do not detail a method to correct the presence of the water, the IIC, ACE, and DGE must be notified before the contractor begins work.

If the contract drawings require that additional material be added to an existing embankment, the existing surface should be proof rolled in compliance with the specifications in PUB 408 Sections 206.3 and 208.3. As specified in PUB 408 Section 208.3, the material should be corrected in areas deemed unstable and, on rare occasions, unsuitable. Material unsuitable due to excessive moisture content should be scarified, dried to a lesser moisture content, and recompacted.

If an embankment is constructed where old concrete or asphalt pavement is present, the existing pavement must be rubblized and recompacted following PUB 408 Section 206.3.

Two items must be monitored constantly as the construction of the embankment proceeds: the moisture content of the material placed and the compaction control of the embankment. Further discussion of compaction control is provided in Section 200.7 of this document and specified in PUB 408 Section 206.

As material arrives at the embankment construction area, it is usually end-dumped by 60-ton dump trucks or dump trucks. Bulldozers are used to level the material to the specified "loose" lift thickness before compaction. Again, attention must be paid to ensuring that material is not placed beyond the limits dictated by the contract documents or in areas where it may load a slope or structure, resulting in slope stability issues or damage to a structure.

The contractor places material with a coarse texture, such as "rock," "random material," or "shale," on the outside of the embankment. Large rocks must be broken into a size suitable for compaction and incorporation into the embankment lift, or if not broken, the rock should be pushed out of the lift for future breaking or removal. Check contract specification requirements for rock embankments and satisfy considerations relative to durability, wetting of materials, use of finer materials to facilitate compaction, use of geotextiles to prevent migration of fines, etc.

When the contract specifies rock embankment up to subgrade elevation, a lift of selected granular material of adequate thickness should be placed on top. This lift of granular material will fill voids in the rock and allow fine grading as specified. A geotextile may also be required to prevent the migration of the finer material topping the rock embankment into the rock embankment.

Embankment areas must be graded and compacted in such a manner that depressions in the surface are kept to a minimum, as well as to permit water runoff. Depressions and low spots in the surface cause water to pool and soak into the embankment, softening the lift. If it is necessary to continue embankment after a rain event, any mud or soft areas should be removed and replaced with suitable material before resuming placement. Equipment travel on a wet embankment surface should be kept to a minimum to reduce damage to previously placed material. The embankment should be sealed with a smooth drum roller at the end of each day or when rain is imminent to prevent water from soaking into the embankment.

The contractor is responsible for the construction, protection, and stability of the new embankment. Should any damage occur from displacement, rutting, natural causes, shrinkage of embankment materials, or carelessness, the contractor is obligated to correct the deficiency at no additional cost to the Department.

The contractor constructs benches in compliance with the contract drawings and cross sections. Granular material is used on the finished surface of the embankment to allow fine grading as specified.

Measuring & Payment Methods

Embankment construction is incidental to the Class of Excavation or Borrow Excavation, except as specified in Section 206.4 for AASHTO Nos. 8 and 57 and PennDOT 2A or Open Graded Subbase (OGS). When payment is indicated, the embankment is measured in its final position by the cubic yard or ton, as specified in PUB 408 Section 203.4.

The preparation of the original ground is paid for under the Clearing and Grubbing, Special Rolling, and Undercutting items provided in the contract. Temporary payments may be made based on assumed truck volume and truckload count, subject to verification of the final volume derived from measurements or cross sections.

Excavation and removal of unsuitable material not addressed by the contract documents may be paid as Class 1, 1A, and 1C Excavations.

5. WASTE MATERIAL

This section addresses the satisfactory disposal of waste material from earthwork operations. PUB 408 Section 105.14 Borrow Areas and Waste Areas specifies two types of waste areas: Non-Designated and Designated.

Non-Designated Area

When the contractor utilizes a Non-Designated Area, the contractor locates the proposed area, which may be inside or outside the ROW and must be located upland, so it does not impact the waters of the United States. Surveys and cross sections must be taken before and after the waste operation to measure the volume of material deposited. The waste area must be reviewed by the Department's Environmental Manager for approval prior to the contractor negotiating a Waste Area Agreement with the property owner if it is outside of ROW. An approved E&S control plan must be submitted and reviewed by the Department before using the waste area.

Designated Area

The Department may have previously selected an area for which waste material is to be deposited, and the contract will specify these locations. For these situations, the contractor must complete the standard agreement for waste areas, but the Department will provide all applicable permits and the E&S control plans.

☐ Review

 Documentation Required

BEFORE WASTE MATERIAL REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐	Review approved Borrow and/or Waste Agreement (Form CS-4345) for material hauled off-site or not within the project limits.	
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Review approved cross section.	MCDocs
☐	Confirm that the contractor has signed the NPDES permit as the co-permittee prior to the start of work.	

DURING WASTE MATERIAL REMOVAL CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Record load counts, if needed, of wasted material.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Record daily that the contractor is following permits for E&S control and that a signed copy of the NPDES permit is onsite.	E&S Permits
☐		Record that wetlands are protected by orange construction fencing when applicable.	E&S Permits
☐		Ensure that any topsoil in the area of excavation has been removed and stockpiled as part of the clearing and grubbing operation.	
☐		Verify the contractor has all required agreements for borrow areas.	
☐		Confirm that survey controls are in place and work is following the stakeout plan or that a GPS grading plan is in use.	
☐		Ensure that waste areas within the ROW do not change or affect existing drainage features.	

AFTER WASTE MATERIAL REMOVAL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Record that the area has been cleaned as needed.	
☐		Verify all disturbed areas have been treated with seeding and mulching if required.	

Material & Equipment

There is no material required for this operation.

Equipment used in the disposing of waste material includes bulldozers, excavators, dump trucks, vibratory steel wheel rollers, soil compactors, and seeding and mulching equipment.

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Mechanical:				
60-Ton Dump Truck	Bulldozer	Dump Truck	Excavator	Hydroseeder
Mulcher	Soil Compactor	Tri-Axle Dump Truck	Vibratory Steel Wheel Roller	
Testing/Inspection:				
Measuring Wheel	Smart Level	Survey Rover	Surveying Rod	Total Station

Construction Methods

The contractor loads waste material from the project into dump trucks or other hauling equipment and hauls the waste to a designated and approved waste area.

The material is placed and compacted in the same manner as for embankment construction. Once all the material is in the waste area, it is graded for positive drainage. The appropriate seeding formula and mulch are then applied. Acceptable growth of the seeding formula is required prior to releasing the contractor from responsibility for the waste area.

At on-site waste disposal areas, frequent moisture-density tests are performed to ensure the soils placed meet specification requirements.

The contractor may be required to perform other items if required by PADEP permits.

Measuring & Payment Methods

Disposal of waste material is incidental to other construction work unless otherwise directed.

6. BORROW EXCAVATION (SEC. 205)

This section addresses Borrow Excavations, which are classified as Common Borrow Excavation, Foreign Borrow Excavation, Selected Borrow Excavation, or Selected Borrow Excavation for Structure Backfill in PUB 408 Section 205, depending on where the material is obtained, where the material is to be used, or the type of material specified. Foreign Borrow Excavation, which is defined as excavating or obtaining embankment material from outside approved sources and borrow areas, has additional requirements as specified in PUB 408 Section 105.14.

Common Borrow Excavation

Common borrow excavation occurs when suitable material is obtained from borrow areas that can be measured before and after excavation for payment. Refer to PUB 408 Section 205.1, Section 205.3, and Section 205.4. The removal of topsoil from borrow areas is included with this item.

Foreign Borrow Excavation

Foreign borrow excavation occurs when embankment material cannot be obtained within the project limits and must be obtained elsewhere. The Foreign Borrow material is borrow excavation that cannot be measured before and after excavation. Refer to PUB 408 Sections 205.1 and 205.3. Foreign Borrow Excavation is measured and paid in cubic yards as compacted material in the completed embankments; refer to PUB 408 Section 205.4. All available excavation within the project must be used for embankments before the contractor may use Foreign Borrow.

Selected Borrow Excavation

Selected borrow excavation occurs when material for the work requires a specific quality, size, and/or gradation and is obtained from sources outside the project limits that cannot be measured before or after excavation. Refer to PUB 408 Sections 205.1, 205.3, and 205.4.

Selected Borrow Excavation for Structure Backfill

Selected borrow excavation for structure backfill is defined as excavating or obtaining material used for structure backfill as shown on the Standard Drawings and as indicated in PUB 408 Sections 205.1 and 205.2 AASHTO Nos. 1, 3, 5, or 57 or PennDOT 2A Coarse Aggregate, meeting at least Type C quality requirements and as specified in PUB 408 Section 703.2 Table B and Section 703.2 Table C; R-3 Rock Lining, as specified in PUB 408 Section 850.2.

☐ Review  Documentation Required

BEFORE BORROW EXCAVATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs

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☐		Task	Reference
☐		Review approved Borrow and/or Waste Agreement (Form CS-4345) for material hauled onto the project from unapproved sources.	
☐		Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐		Review approved cross section.	MCDocs
☐		Confirm that the contractor has signed the NPDES permit as the co-permittee prior to the start of work.	
☐		Ensure all available excavations from the project have been used prior to using borrow excavation.	
☐		Verify Borrow Excavation pits have been submitted for approval at least two weeks prior to use and preliminary testing has been submitted to the DGE for Department review.	
☐		Ensure cross sections of Common Borrow sites have been completed prior to beginning excavation.	

DURING BORROW EXCAVATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Record topsoil has been removed and stockpiled at the borrow site.	
☐		Record load counts, if needed, of borrow material.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Verify the contractor is following permits for E&S control and that a signed copy of the NPDES permit is onsite.	E&S Permits
☐		Confirm that wetlands are protected by orange construction fencing when applicable.	E&S Permits
☐		Verify results of any material sampling or certifications for select borrow excavation.	
☐		Ensure that the contractor has all required agreements for borrow areas.	

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☐		Task	Reference
☐		Verify that survey controls are in place and work is following the stakeout plan or that a GPS grading plan is in use.	
☐		Identify changes in materials that would require additional sampling, testing, or approvals.	

AFTER BORROW EXCAVATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Record that the area has been cleaned as needed.	
☐		Document all disturbed areas have topsoil replaced and have been treated with seeding and mulching if required.	
☐		Verify final cross sections have been taken for common borrow areas.	
☐		Take final pictures of completed borrow sites.	

Material & Equipment

Material used for select borrow excavation for structure backfill may include AASHTO No. 1, No. 2A, No. 3, No. 5, or No. 57 Coarse Aggregate, meeting at least Type C quality requirements, and R-3 Rock.

Equipment used for borrow material includes bulldozers, excavators, dump trucks, vibratory steel wheel rollers, soil compactors, and seeding and mulching equipment.

Mechanical:				
60-Ton Dump Truck	Bulldozer	Dump Truck	Excavator	Hydroseeder
Mulcher	Soil Compactor	Tri-Axle Dump Truck	Vibratory Steel Wheel Roller	
Testing/Inspection:				
Measuring Wheel	Smart Level	Survey Rover	Surveying Rod	Total Station

Construction Methods

When borrow excavation is required, excavation cannot begin until the material and placement sequence have been accepted in writing and an E&S control plan has been submitted and accepted by the PACD, the PADEP, and PennDOT. The Department also requires a signed agreement with the property owner when borrow material is taken from private property. Check that all E&S control devices are in place and operational before excavation.

Borrow excavation for embankment construction is only utilized when available excavation from the project has been exhausted, excavation from the project is unsuitable (the moisture content of the excavated material does not make it unsuitable), the material needed for embankment is specified in a special gradation or type, or when the staging of the construction on the project makes the project excavation unavailable at the time it is needed (i.e., a temporary roadway embankment is needed to shift traffic prior to excavation on the project beginning).

Borrow pits should be identified early enough to allow sufficient time for sampling and laboratory testing, if necessary. Test results must be forwarded to the DGE before the material is incorporated into the project. If more than one type or classification of material is obtained from the same borrow pit, separate samples must be taken, tested, and submitted for each type of material. These separate materials must be removed consecutively to segregate the different materials, and the pit must be sectioned between the different operations. Samples of the different materials are not to be mixed. All PUB 408 Section 206.1 rock sources **MUST** be approved by the DGE before use. The inspector should ensure the borrow pit is cleared of vegetation, debris, unsuitable material, topsoil, and overburden before production work begins. The removed topsoil is stockpiled for reuse in restoring the pit. During excavation, the material is monitored for changes. The DGE must be notified of changes, and if previously unsampled material is found during borrow pit excavation, additional sampling and testing are required.

When designated as Common Borrow, final cross sections must be taken after the last of the material is removed from the borrow pit. After completion of the cross sections, the borrow pit should be restored according to the approved restoration measurements and payment methods.

Measuring & Payment Methods

Refer to PUB 408 Section 205.4 for complete payment methods.

Common Borrow Excavation

Common borrow excavation is measured per PUB 408 Section 203.4 based on cross sections of the borrow area.

Foreign Borrow Excavation

Foreign borrow excavation is paid in cubic yards of completed embankment.

Select Borrow Excavation

Select borrow excavation is paid as specified in the contract as cubic yards in place or on a weight basis in tons.

Select Borrow Excavation for Structural Backfill

Select borrow excavation for structural backfill is paid in cubic yards in place of a completed embankment.

7. COMPACTION (SEC. 206)

This section addresses the proper placement and compaction of embankments, fills, and backfills. Compaction methods and equipment will be explained, as well as how they apply to embankment construction, benches, and subgrade. PUB 408 Section 206 provides the specification for Placement and Compaction of Embankment and Fill. The contractor obtains embankment material, fill, or backfill construction from various classes of excavation on the project or off-project sources as specified.

☐ Review  Documentation Required

BEFORE COMPACTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review the Compaction Requirements and Equipment Factors Presentation .	
☐	Review approved E&S control plans and permits.	MCDocs
☐	Review contract ROW plans and notes.	MCDocs
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Review approved cross section.	MCDocs
☐	Ensure that the contractor has signed the NPDES permit as the co-permittee prior to the start of work.	
☐ 	Verify that testing of material if applicable has occurred for the embankment material proposed, and the material has been classified into one of the six categories in PUB 408 Section 206.2.	
☐ 	Confirm that the contractor has submitted a compaction QC plan if required.	PPCC
☐ 	Ensure that the contractor has submitted the compaction equipment proposed for the embankment construction.	
☐ 	If the contractor has proposed or the Contract has specified material classified as PUB 408 Section 206.2(a)1.d Rock, verify that the DGE has approved the source of the rock.	

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☐		Task	Reference
☐		Confirm the embankment foundation area has been prepared in accordance with PUB 408 Section 201.	
☐		Record that required cure time has occurred for a structure prior to backfilling with selected excavation.	

DURING COMPACTION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that the contractor has the approved compaction equipment onsite.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Verify that the contractor is following permits for E&S control and that a signed copy of the NPDES permit is onsite.	E&S Permits
☐		Confirm that wetlands are protected by orange construction fencing when applicable.	E&S Permits
☐		Verify results of any material sampling or certifications for embankment.	
☐		Confirm if the material compaction will be monitored using nuclear gauge testing or non-movement.	
☐		Accept embankment material after compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐		Verify that the lift sizes meet the specifications for the material, compaction equipment used, and any results of density testing for each lift as required.	
☐		Confirm when the appearance or type of material changes, that maximum density testing and optimum moisture testing have been completed if required.	
☐		Verify that each lift is sealed with a roller and graded to drain for periods of non-work.	

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☐		Task	Reference
☐		Ensure conditions are corrected if rutting or unstable conditions are observed during lift placement.	
☐		Verify that survey controls are in place and work is following the stakeout plan or that a GPS grading plan is in use.	

AFTER COMPACTION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials used for embankment and/or backfill are those available from excavation on the project or acquired from approved sources as specified by the contract.

Equipment includes diverse sizes of vibratory plate compactors, loaded tri-axle dump trucks, vibratory steel wheel rollers, tandem steel wheel rollers, pneumatic tire rollers, three-wheel rollers, sheepsfoot rollers, and vibratory plate compactors. Equipment requirements are specified in PUB 408 Sections 108.05 and 206.3.

The contractor also needs testing equipment, including either sand cone apparatus or nuclear gauge testing equipment, to evaluate the compacted density of the applicable material types, as specified in the contract.

Mechanical:				
60-Ton Dump Truck	Bulldozer	Excavator	Hydroseeder	Mulcher
Pneumatic Tire Roller	Sheepsfoot Roller	Soil Compactor	Tandem Steel Wheel Roller	Three-Wheel Roller Compactor
Tri-Axle Dump Truck	Vibratory Plate Compactor	Vibratory Steel Wheel Roller		
Testing/Inspection:				
Measuring Wheel	Nuclear Gauge	Proctor Test Equipment	Sand Cone Apparatus	Smart Level
Survey Rover	Surveying Rod			

Construction Methods

The material used for roadway embankments, structure backfill, or other embankment work is placed in layers, commonly called lifts. PUB 408 Section 206.3 and PUB 72M provide the specifications for placing these materials. Prepare subgrade and embankment areas as specified in PUB 408 Sections 201.3, 203.3, 206.3, and 208. When undercutting the existing embankment foundation area is not indicated, the area must be proof rolled before embankment construction as specified in PUB 408 Section 206.3. Proof rolling occurs using a loaded tri-axle dump truck (72,000 Gross Vehicle Weight (GVW)). Proof rolling may also be requested by the Department Representative any time the embankment construction appears to be visually unstable. The stability of embankments constructed for the contract remains the responsibility of the contractor.

Material compaction is the process of densifying the embankment material. The benefits of proper compaction (or densifying) include increased embankment stability, reduced compressibility or settlement, and increased load-bearing capacity of the material. Material compaction can be achieved using various methods and equipment. The various methods and equipment used to densify the material reduce the number of air voids between the solid particles of the material. These solid particles may be comprised of soil, natural or synthetic mineral aggregate, rock, shale, or random material. A given material is fully compacted (maximum density) when the air spaces or voids between particles are limited to their smallest possible configuration. Compaction effort, lift sizes, and moisture content are critical in obtaining a dense and stable embankment. Compaction effort is controlled by the selection of the specific equipment (i.e., size, type, weight, or vibration) or the duration of its use (the number of passes or time the equipment is used in the densifying task).

The moisture content of a given material also directly correlates to the material's ability to be compacted to its maximum density. Too little or too much moisture prevents the embankment material from compacting to its maximum density. In PUB 19 PTM 106 Moisture-Density Relations of Soils, test results generate a material-specific curve that defines the maximum density of the material as a function of the optimum moisture content. Different material types and samples will have different moisture-density curves.

Figure 7-1 depicts a typical moisture density curve plot. This plot is generated via PennDOT Form TR-4247 and is based on specific embankment material properties tested, determined from a site-specific obtained sample. For this specific test, a sample of the material was compacted from 4.5% to 8.5% moisture content. The maximum density occurred with a moisture content of 6.5%.

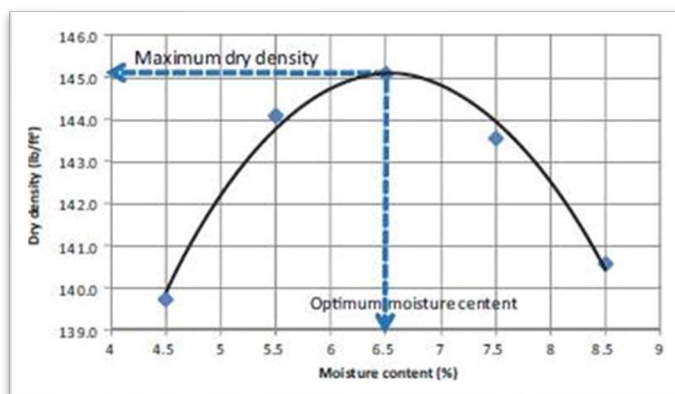


Figure 7-1: Example of a plotted Moisture-Density Curve

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The different types of embankment materials are specified in PUB 408 Section 206.2 and are broken down into six classifications, which vary in type, gradation (i.e., distribution of particle sizes), and physical composition/origin (e.g., plasticity, hardness, durability).

The first two embankment materials in PUB 408 Section 206.2 meet the classifications of "Soil" and "Type 1 Granular Material." These two materials require the contractor's certified materials technician to perform nuclear gauge testing upon placement and compaction of each lift placed, as specified in PUB 408 Section 206.3. For material types requiring nuclear gauge testing, the material should be compacted to the specified maximum density within the permissible variability in optimum moisture content, as stated in Section 206.3.

The embankment materials meeting the classification of "Type 2 Granular Material," "Rock," "Shale," or "Random Material" require the Department Representative to evaluate the compaction of each lift placed by visual non-movement criteria as specified in PUB 408 Section 206.3.

Compaction test results or visual assessments (as applicable) must be obtained, evaluated, and accepted prior to placing the next lift. The PennDOT Forms TR-4276A Report on Compaction Density by Nuclear Method and TR-478A Report on Compaction Density Non-Movement are to be used by the Representative based on the criteria the compacted material type is required to meet. Additional compaction guidance is available in the PennDOT Compaction Manual (2020) and PUB 293 Chapter 9.

Embankment material should be placed in full-width layers at specified thicknesses (lifts). The lift thickness will vary depending upon the type of material placed and equipment used; the project specifications will prescribe whether the lift thickness is in terms of "loose" or "compacted." Before placing additional embankment material, each lift should be constructed to meet the compaction requirements for the material type placed (i.e., non-movement criteria or nuclear gauge density testing). Below is a summary of **PUB 408 Section 206: Embankment Placement and Testing Requirements**. The inspector needs to confirm that the summary applies to the specific contract.

Embankment Pub. 408 Section 206 Change #3 Summary						
Material	Size requirements	Description	Lift thickness (compacted)	Nuke vs. non- movement	Roller requirement	Other
Soil	20 % or more passing No. 200 sieve Max. LL=65; PI> LL-30	Soil with fines	6 inches	Nuke -3% opt moisture	Pad foot / static	Overbuild at subgrade, then fine grade to correct elevation. Direct transmission
Granular Material, Type 1	>70% passing 3/8-inch sieve (<30% retained) <20% passing No. 200 sieve	Granular with more sand/fines	6 inches	Nuke ≈/- 2% opt moisture	Smooth drum / vibratory	Direct transmission Backscatter method can be used if material is too coarse for direct transmission
Granular Material, Type 2	</- 70% passing 3/8-inch sieve (> 30% retained) <20% passing No. 200 sieve	Gravel with less sand/fines No. 8, No. 57, 2A, OGS, 2RC, structure backfill	8 inches	Non- movement Surface damp	Smooth drum / vibratory	Different requirements for pipe trenches
Rock	Rock material that cannot be readily incorporated into compacted 6-inch lifts	Blasted or ripped rock, boulders, detached stones. concrete or masonry units Limited fines	Approximate average size of larger rock, max 36 inches	Non- movement	Smooth drum / vibratory	Choke with 2RC and cover with Class 4 Type A geotextile, then additional layer of 2RC prior to subgrade elevation.
Notes:						
• Proof Rolling incidental to embankment. • Compaction Control QC Plan (CS-206) Required from contractor, if material can be monitored with a nuclear gauge. • Contractor to provide certified nuclear gauge and operator for acceptance testing. Dept. will do verification testing. • Non-movement form must be completed if nuclear gauge is not used. For 2A, continue to contact the Geotechnical Unit for assistance.						

PUB 408 Section 206: Embankment Placement and Testing Requirements

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For locations where the compacted embankment material is verified using a nuclear gauge, Form CS-206 is to be completed by the contractor. The contractor must submit a compaction control QC plan as outlined on Form CS-206 for review by the Department representative. A QC plan is not required when placing and compacting material, as specified in PUB 408 Section 206.3.

The equipment type used in the embankment construction impacts the compaction. A roller is an example of full-scale compaction equipment that is manufactured with differing operating weights, having either a single drum, tandem drum, or pneumatic tire, using either a Padfoot or smooth drum, and operating in static or vibratory modes. Lightweight compaction equipment includes hand-operated impact rammers (jumping jacks), hand-operated vibratory plate compactors, and walk-behind rollers.

PUB 408 Section 206.3 specifies the permitted compaction equipment types based on the embankment material and lift thickness to be compacted. Verification of the contractor's proposed compaction equipment type is to be completed by the contractor using the equipment factor equations in PUB 408 Section 108.05. The Department Representative should review and approve the contractor's proposed compaction equipment that meets the minimum required equipment factor of 2.0. Equipment approved for one type of embankment material may not be suitable for a different embankment material.

As shown in **Figure 7-2**, Form CS-206, Section IV, lists the proposed equipment, and the contractor is to provide a calculation showing that the proposed equipment meets a minimum required equipment factor based on the equations specified in PUB 408 Section 108.05.

III. MATERIAL INFORMATION			
Material Class	Dry Density, pcf	Optimum Moisture, %	Proctor Test Date

IV. EQUIPMENT LIST		MANUFACTURER	QUANTITY
<i>A sufficient quantity and type of rollers and/or compaction equipment must be available and used in accordance with Pub 408, Section 206.3(b).</i>			
Pad Foot Roller			
Smooth Drum Vibratory Roller			
Other (please specify below)			

Figure 7-2: PennDOT Form CS-206, Section IV Equipment List

For locations where the compacted embankment material is verified according to non-movement criteria, the contractor is to provide a list of equipment similar to that shown in **Figure 7-3** and include the associated calculations showing that the proposed equipment meets the minimum required equipment factor, based on the equations specified in PUB 408 Section 108.05.

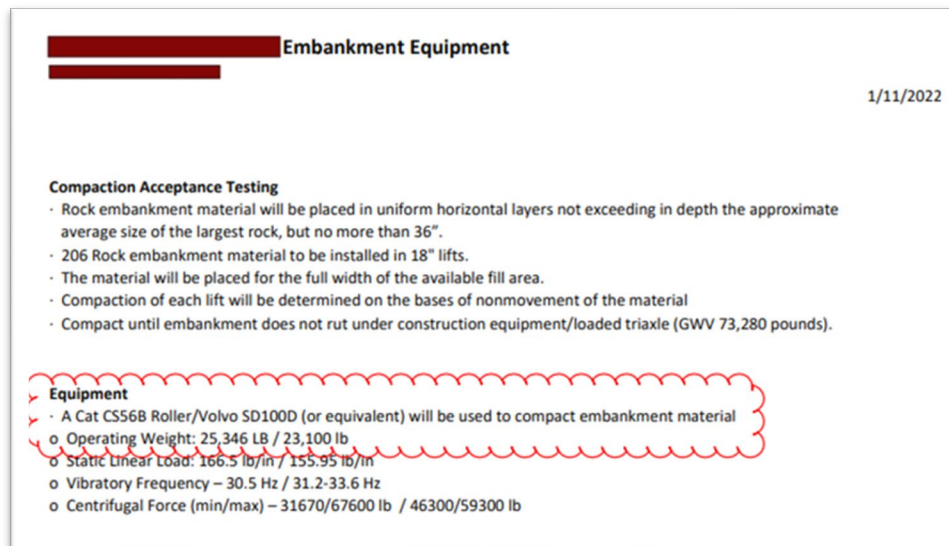


Figure 7-3: Example Summary of Compaction Equipment

In both cases, the Department Representative is to verify what embankment material type is being compacted, verify that the equipment type is allowable for the embankment material type per PUB 408 Sections 206.2 and 206.3, and verify that the proposed equipment meets the required minimum equipment factor per PUB 408 Section 108.05.

Examples of these calculations are available on the PennDOT gINT/Geotechnical website: [gINT / Geotechnical](#), under "Documentation Links" > "Compaction Requirements and Equipment Factors Presentation."

Measuring & Payment Methods

Placement and compaction are incidental to either embankment or excavation. Embankments constructed using AASHTO Nos. 8 or 57 or PennDOT No. 2A or OGS meeting the requirements specified in PUB 408 Section 703.2 and Select Granular Material (2RC) meeting the requirements specified in Section 703.3 are measured and paid by the tons or cubic yard. Refer to PUB 408 Section 206.4 for complete payment methods.

8. SUBGRADE (SEC. 210)

This section addresses subgrade, as specified in PUB 408 Section 210, which is the top 3 feet of embankment material directly below the pavement structure (defined as pavement, base, and subbase) or the lowest point of an excavation in a cut area. In either situation, the subgrade is located at a point below the subbase of the pavement structure. Subgrades constructed as part of embankment construction are considered newly constructed subgrades. Subgrades beneath existing pavements to be reused are considered existing subgrades. The stability of a newly constructed subgrade is the responsibility of the contractor. Existing subgrades must be evaluated by proof rolling to determine if they are stable.

The finished subgrade also provides the final drainage surface for water finding its way through the subbase. In addition to a smooth appearance, the subgrade must have the strength or bearing capacity to provide uniform support for the overlying pavement structure. If the subgrade does not have adequate strength or bearing capacity, failure of the pavement structure will occur.

☐ Review  Documentation Required

BEFORE SUBGRADE OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Review approved cross section.	MCDocs
☐ 	Confirm that testing of material if applicable has occurred for the subgrade proposed.	
☐ 	Ensure that the contractor has submitted a compaction QC plan if required.	
☐ 	Verify that the contractor has submitted the compaction equipment proposed for the subgrade construction.	
☐ 	Confirm the subgrade foundation area has been prepared in accordance with PUB 408 Section 201.	
☐ 	Confirm grade stakes are set and Form D-413 has been accepted.	

DURING SUBGRADE OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document that the contractor has the approved compaction equipment onsite.	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Verify that the contractor is following permits for E&S control and that a signed copy of the NPDES permit is onsite.	E&S Permits
☐		Verify results of any material sampling or certifications for embankment.	
☐		Verify that the lift sizes meet the specifications for the material, compaction equipment used, and any results of density testing for each lift as required. Subgrades require 100% of dry density.	
☐		Ensure conditions are corrected if rutting or unstable conditions are observed during lift placement.	
☐		Verify that survey controls are in place and work is following the stakeout plan or that a GPS grading plan is in use.	
☐		Confirm any stabilization methods and locations utilized.	
☐		Verify areas where the subgrade has been fine-graded and accepted within specification tolerances, with no low spots, soft areas, or objectional material.	

AFTER SUBGRADE OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials used for subgrade construction are those available from embankment construction on the project or acquired from approved sources as specified by the contract.

Section 200: Earthwork

Equipment includes diverse sizes of vibratory compactors, tri-axle dump trucks, vibratory steel wheel rollers, tandem steel wheel rollers, three-wheel rollers, pneumatic tire rollers, sheepsfoot rollers, and vibratory plate compactors. Equipment requirements are specified in PUB 408 Section 206.3, regarding PUB 408 Section 108.05.

The contractor also needs testing equipment, including either sand cone apparatus or nuclear gauge testing equipment, to evaluate the compacted density of the applicable material types or as specified in the contract.

Mechanical:				
60-Ton Dump Truck	Bulldozer	Excavator	Hydroseeder	Mulcher
Pneumatic Tire Roller	Sheepsfoot Roller	Soil Compactor	Tandem Steel Wheel Roller	Three-Wheel Roller Compactor
Tri-Axle Dump Truck	Vibratory Plate Compactor	Vibratory Steel Wheel Roller		
Testing/Inspection:				
10-foot Straight Edge	Measuring Wheel	Nuclear Gauge	Proctor Test Equipment	Sand Cone Apparatus
Smart Level	Survey Rover	Surveying Rod	Total Station	

Construction Methods

PUB 408 Section 201.3 requires the contractor to remove all stumps and roots to a depth of at least 2 feet below subgrade or slope surfaces. Any existing pavements within 3 feet of the finished subgrade must be completely removed unless otherwise specified in the contract documents. Pavements deeper than 3 feet from the finished subgrade must be broken per PUB 408 Section 206.3.

When new material is used to create the subgrade, maintain the materials as specified in PUB 408 Section 206.3. Prepare and compact the subgrade as specified in PUB 408 Section 206.3. Unsuitable materials below the subgrade are removed by the contractor by using Class 1A excavation for bottom widths less than 8 feet. For excavation widths greater than 8 feet, use Class 1C Excavation to remove unsuitable materials. If the subgrade has been in place for more than 60 days before pavement structure placement or if the subgrade was exposed to at least one winter season, compact and proof roll the entire subgrade surface.

When undercutting is not specified in the contract or plans as part of existing subgrade preparation, proof roll the area as specified in PUB 408 Section 208. Keep all embankments and excavations sealed with a smooth drum roller used in static mode and slope the surface to drain to keep it from becoming saturated.

After proofrolling a subgrade, the Department Representative will determine if the subgrade is stable and satisfactory. PUB 408 Section 208.3 specifies the criteria for a stable subgrade. Standard requirements for stabilizing subgrades deemed unsatisfactory are covered in PUB 408 Section 208.3.

Section 200: Earthwork

Alternatively, designers may recognize situations where special methods or procedures are required to provide a stable subgrade. Any subgrade stabilization methods deviating from the standard requirements will be documented in the contract's special provisions and/or approved contract drawings, outlining the required construction methods.

Grade control is imperative for proper subgrade construction. The contractor places grade lines or grade stakes following PUB 408 Section 210.3. Reference grade lines or stakes must remain in place until the subgrade surface is complete and accepted. Test for transversal irregularities using a string line at intervals not to exceed 25 feet. As an alternative, use a 10-foot straight edge to test for longitudinal irregularities. Correct any surface irregularity that exceeds $\frac{1}{2}$ inch. Recheck the corrected subgrade areas for grade and shape.

When subgrades are constructed using survey-grade GPS systems, laser technology, or a combination of both, checking of surface cross sections occurs at intervals not to exceed 500 feet. Correct any surface irregularity that exceeds $\frac{1}{2}$ inch. When using GPS or laser technology, the contractor must set construction stakes on tangent sections at intervals not exceeding 500 feet for the entire length of the project. Construction stakes must also be set at radial offsets at 500-foot intervals for curves. Refer to PUB 408 Section 210.3. The contractor must tabulate the offsets and elevations of all stakes using Form D-413 (Grade Sheet) from PUB 122 Appendix C and submit it to the Representative.

Completed subgrades on embankments must be compacted to 100 percent of the maximum dry density. Determine the in-place dry density of the soil according to PUB 19 PTM 402 using the direct transmission method.

After acceptance of the subgrade, following PUB 408 Section 210.3, place a Class 4 Type A geotextile over the completed subgrade for the entire lane width of 8 feet or greater before placing the subbase.

Measuring & Payment Methods

Construction of the subgrade and all components of the operation are incidental to the immediate overlying structure and are not payable as separate items.

Removal of unsuitable material in cut areas is paid as either Class 1A or Class 1C Excavation, depending on the bottom width as specified in PUB 408 Section 203.

9. GEOTEXTILES (SEC. 212)

This section addresses the use and application of geotextiles in earthwork activities such as Geosynthetic Reinforced Soil (GRS) slopes, grade stabilization, and E&S control.

Geotextiles are identified by class and type based on their intended use. The composition of these fabrics and physical requirements are specified in PUB 408 Section 735, with the intended application and placement details specified in PUB 408 Section 212.

A summary of the class, type, and applications of geotextiles in earthwork is as follows:

Class 1 - Subsurface Drainage

Refer to PUB 408 Section 212.3 and PUB 72M RC Standard 30M for construction details.

Class 3 Type A - Sediment Control

Refer to PUB 408 Section 865.3 for Silt Barrier Fence and PUB 72M RC Standard 70M for construction details.

Class 3 Type B - Sediment Control

Refer to PUB 408 Section 866.3 for Heavy Duty Silt Barrier Fence and PUB 72M RC Standard 70M for construction details.

Class 4 Type A - Layer Separation & Erosion Control

Refer to PUB 408 Section 212.3 and as shown on PUB 72M RC Standards for construction details.

Class 4 Type C - Stabilization & GRS Abutments

Refer to PUB 408 Section 212.3 and as shown on PUB 72M RC Standards for construction details.

☐ Review

 Documentation Required

BEFORE GEOTEXTILE OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐	Verify areas where the subgrade has been fine-graded and accepted within specification tolerances, with no low spots, soft areas, or objectional material.	

Section 200: Earthwork

☐		Task	Reference
☐		Verify that required easements and permits are submitted, processed, approved, and on file in the project office prior to beginning work.	
☐		Ensure the area to receive geotextile is cleared of vegetation, large rocks, and debris.	
☐		Verify compaction testing, if required, is also completed.	

DURING GEOTEXTILE OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the geotextile is placed in a loose and unstretched manner without wrinkles, reducing the potential for fabric shifting, puncturing, or tearing.	
☐		Verify geotextile is pinned with steel securing pins or as otherwise specified.	
☐		Confirm adjoining edges are overlapped or sewn as specified.	
☐		Verify equipment is not permitted directly on the placed fabric.	
☐		Ensure any fabric that is damaged is removed and replaced.	

AFTER GEOTEXTILE OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials for this work include the indicated or specified geotextile material and steel securing pins.

Equipment includes 60-ton dump trucks and tri-axle dump trucks, vibratory steel wheel rollers, bulldozers, excavators, and soil compactors.

Section 200: Earthwork

Mechanical:				
60-Ton Dump Truck	Bulldozer	Excavator	Soil Compactor	Tri-Axle Dump Truck
Vibratory Steel Wheel Roller				
Testing/Inspection:				
10-foot Straight Edge	Measuring Wheel	Smart Level	Survey Rover	Surveying Rod
Total Station				

Construction Methods

Prior to the use or placement of geotextile, the area should be prepared satisfactorily. Preparation includes clearing vegetation, large stones, and other debris and grading to a smooth condition. Any remedial work or compaction must be completed before placing the fabric.

The contractor must place the fabric in a manner that avoids wrinkling material and in a loose, unstretched condition to lessen the chance of shifting, puncturing, or tearing the material. Remove and replace fabric areas damaged during construction. If the fabric is not wide or long enough to cover the designated area, joining edges are either overlapped or sewn, as specified. Steel pins or an alternate securing method (if approved) are used to anchor the fabric in place. Equipment is not permitted on the placed fabric. Geotextiles can degrade in sunlight and should be stored away from direct sunlight and installed such that exposure to direct sunlight is limited. Specific geotextiles are required for specific applications/functions and cannot be substituted.

Measuring & Payment Methods

Payments for the placement of geotextile are as follows:

Class 1 - Subsurface Drainage

Paid by the linear foot and measured by the length of the trench.

Class 3 Types A & B – Sediment Control

Paid by the square yard for the type indicated or specified, except when used as a silt barrier fence paid for under PUB 408 Sections 865 or 866.

Class 4 Type A - Layer Separation & Erosion Control & Type C - Stabilization & GRS Abutments

Paid by the square yard for the type indicated or specified.

Geotextiles may be incidental to other operations, as specified. Refer to PUB 408 Section 212.4.

10. FLOWABLE FILL (SEC. 220)

This section addresses the application of flowable backfill, a mixture of coarse aggregate, fine aggregate, water, and air-entraining agents (cement or pozzolans or a combination of both). Flowable backfill may also include bottom ash or other admixtures. For additional descriptions, materials, and construction details, refer to PUB 408 Section 220.

Flowable backfill is designated by type for use as follows:

Type B

Type B is used when future excavation of the backfill may be necessary, as at utility trenches, pipe trenches, bridge abutments, and around box or arch culverts.

Type C

Type C is used when excavation of the backfill is not anticipated, including replacing unsuitable soils below structure foundations, filling abandoned conduits, tunnels, and mines, and backfilling around pipe culverts where extra strength is required.

Type D

Type D is used for construction in areas requiring low-density backfill material, as in abutments over highly deformable soils, backfilling retaining walls, filling vaults, and backfilling buried structures.

☐ Review

 Documentation Required

BEFORE FLOWABLE FILL OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review approved E&S control plans and permits.	MCDocs PPCC
☐	Review contract ROW plans and notes.	MCDocs
☐ 	Verify that mix design and field operation QC plan are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING FLOWABLE FILL OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure all work is being conducted within the existing ROW. Notify IIC if work is occurring outside of the acquired ROW.	
☐		Record methods used for sampling and testing.	
☐		Record any unusual occurrences, such as loss of concrete in the fill area.	
☐		Confirm material delivered matches the mix designs and contract requirements.	

AFTER FLOWABLE FILL OPERATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Record that the area has been cleaned as needed.	

Material & Equipment

There is no material for this operation.

Equipment used for flowable fill includes excavators, concrete mixer trucks, cranes, and concrete pump trucks. The contractor also needs concrete testing equipment.

Mechanical:				
Concrete Mixer Truck	Concrete Pump Truck	Crane	Excavator	
Testing/Inspection:				
Concrete Testing Equipment	Smart Level	Survey Rover	Surveying Rod	Total Station

Construction Methods

Prior to the start of work, mix designs and test results (density and strength) are submitted, processed, approved, and placed on file in the project office.

Section 200: Earthwork

The type of flowable backfill material used is based on and mixed according to the specifications. Before placement, the area is prepared as indicated in the contract plans and placed according to PUB 408 Section 220.

The contractor submits a sequence of operations at least four weeks before work. If formwork is required, construct formwork as specified in PUB 408 Section 1001.3.

Flowable fill should not be placed in flowing water. If the area cannot be dewatered, the flowable fill must be placed in static elevation water with a tremie procedure.

Measuring & Payment Methods

Payment for flowable backfill is by the cubic yard for the type indicated. Check the contract; flowable backfill may be incidental to other operations as specified.

REFERENCES

Accepted Blasting Plan and Accepted Blasting Safety Plan – [PPCC](#)

Agreement between the Property Owner and the Department – [PPCC](#)

Approved Demolition Plan – [PPCC](#)

Approved Erosion and Sediment Control Plan – MCDocs

Approved Permits and Agreements – MCDocs

Approved Quality Control Plan – [PPCC](#)

Approved Right-of-Way Plan – MCDocs

Approved Waste Area – [PPCC](#)

Borrow and/or Waste Agreement (signed by the property owner) – [PPCC](#)

[CS-206](#) Minimum Quality Control Plan Form

[CS-4345](#) Borrow and/or Waste Agreement Form

[Federal Register](#), Volume 55, No. 224 National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule

[PennDOT Compaction Manual \(2020\)](#)

[PennDOT gINT / Geotechnical Resource](#)

[PUB 2](#) Project Office Manual

- Appendix A, Soil and Earthwork Forms (Method for Calculation of Moisture Density Relationship Form TR-4247)
- Appendix A, Soil and Earthwork Forms (Report on Compaction Density by Nuclear Method Form TR-4276A)
- Appendix A, Soil and Earthwork Forms (Report on Compaction Density Non-Movement Form TR-478A)

[PUB 19](#) Field and Laboratory Testing Manual

- PTM 106 (The Moisture-Density Relations of Soils (Using a 5.5-lb. Rammer and a 12” Drop))
- PTM 402 (Determining In-Place Density and Moisture Content of Construction Materials by Use of Nuclear Gauges)

[PUB 72M](#) Roadway Construction Standards

- RC Standard 10M (Classification of Earthwork)
- RC Standard 11M (Classification of Earthwork for Structures)
- RC Standard 12M (Backfill at Structures)
- RC Standard 30M (Subsurface at Drains)
- RC Standard 70M (Perimeter Control Devices)

[PUB 75](#) Construction Inspector-In-Charge Reference Guide

- Part B (Construction), Section B.4 Material Control

[PUB 122](#) Surveying and Mapping Manual

- Appendix C, Standard Forms (Grading Sheet D-413)

Section 200: Earthwork

[PUB 213](#) Temporary Traffic Control Guidelines - Supplementing Federal Highway Administration's Manual on Uniform Traffic Control Devices (Color)

[PUB 293](#) Geotechnical Engineering Manual

- Chapter 9 (Compaction of Embankments and Fills)
- Chapter 10 (Acid-Producing Rock)

[PUB 408](#) Highway Construction Specifications

- Section 105 (Control of Work)
- Section 108 (Performance and Progress)
- Section 110 (Payment)
- Section 201 (Clearing and Grubbing)
- Section 202 (Total Demolition or Partial Demolition of Buildings and Other Structures)
- Section 203 (Class 1, Class 1A, Class 1B, and Class 1C Excavation)
- Section 204 (Class 2, Class 3, Class 4, and Existing Ditch Cleaning)
- Section 205 (Borrow Excavation)
- Section 206 (Placement and Compaction of Embankment and Fill)
- Section 207 (Blasting for Rock Cut Slope Excavation)
- Section 208 (Special Rolling)
- Section 210 (Subgrade)
- Section 212 (Geotextiles)
- Section 213 (Temporary Project Air Pollution Control)
- Section 214 (Sealing Abandoned Water Wells and Springs)
- Section 220 (Flowable Backfill)
- Section 703 (Aggregate)
- Section 735 (Geotextiles)
- Section 801 (Stockpiling Topsoil or Topsoil Mixture)
- Section 804 (Seeding and Soil Supplements)
- Section 805 (Mulching)
- Section 850 (Rock Lining)
- Section 865 (Silt Barrier Fence)
- Section 866 (Heavy Duty Silt Barrier Fence)
- Section 1001 (Cement Concrete Structures)

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SECTION 300: BASE COURSES

GOALS

- Ensure the BEST possible riding surface is obtained for the motoring public.
- Ensure the BEST base course is constructed which will provide a durable pavement.
- Ensure that EVERY area of the base course pavement has been properly compacted.

BASE COURSE SAFETY

- **Traffic Control:** Properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** A base course operation has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Nuclear Gauge:** Ensure the operator is wearing a badge and safely storing the source rod prior to moving.

1. SUBBASE (SEC. 350)

This section addresses the preparation of the subgrade and the placement of a compacted aggregate subbase in accordance with PUB 408 Section 350.

☐ Review  Documentation Required

BEFORE SUBBASE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that for subbase quantities greater than 1,500 tons, the contractor, if directed, has prepared and submitted a subbase delivery plan to the Department Representative for approval prior to beginning operations.	PPCC
☐	Verify subgrade is prepared and that Class 4 Type A geotextile is placed as specified in PUB 408 Section 210.2.	
☐	Review and accept subgrade prior to placing subbase.	
☐ 	Verify the proper moisture of the material at delivery.	eTicketing

DURING SUBBASE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Ensure the subbase is not placed on soft, muddy, or frozen areas.	
☐	Verify the contractor is controlling the subbase depth and elevation per plans and PUB 408 Section 210.3.	
☐ 	Confirm the subbase material is placed without segregation.	
☐	Ensure the subbase is compacted and maintained at least 1,500 linear feet in advance of placing the succeeding paving course.	
☐	Verify the subbase is continually compacted to non-movement. Conduct visual non-movement compaction tests at locations as	

Section 300: Base Courses

☐ 	Task	Reference
	determined using PUB 19 PTM 1 and at the frequency in accordance with PUB 408 Section 206.3. Record the results on Form TR-478A .	
☐	Test depth at each compaction test location.	
☐	If the subbase is deficient by ½ inch or more from the required depth, it is considered defective. Verify it is either corrected or removed and replaced.	
☐	Retest any subbase that was open to weather for 60 days or more for surface irregularities and depth.	
☐	Ensure that if the subbase is left exposed over the winter, it is proof-rolled before placing the next pavement layer.	
☐	Test the surface for grade, slope, and irregularities at longitudinal intervals of not more than 25 feet according to PUB 408 Section 210.3.	

AFTER SUBBASE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the base course is protected from damage prior to placing the next course in the pavement structure.	
☐	For a subbase in place over winter without a protective layer, ensure it is proof rolled before placing flexible or rigid pavements.	

Material & Equipment

The aggregate used for the subbase is Type S or better, Type 2A, and/or open graded subbase (OGS) as specified in PUB 408 Section 703. The aggregate must be supplied by a supplier listed in PUB 34 Bulletin 14 and on the contractor's approved material source of supply. Prior to payment, the contractor must provide a copy of the material certification for the aggregate (Form CS-4171) as specified in PUB 408 Section 106.

Class 4 Type A geotextile is placed as specified in PUB 408 Section 210.

The contractor uses a grading machine and vibratory steel wheel roller in constructing the subbase. To place the base material, the contractor must back dump and spread the subbase ahead of all equipment. Spreading of the subbase should be done in a manner that does not cause segregation, maintains a uniform depth of the layer being placed, and does not disturb the

Section 300: Base Courses

Class 4 Type A geotextile. The contractor may use an auto-grader to trim the subbase to grade. Rollers meeting the requirements of PUB 408 Section 108 are used to compact the base material.

The compaction is checked manually for non-movement under the compaction equipment, with the results recorded on Form TR-478A (Report on Compaction Density Non-Movement).

Mechanical:				
Articulated Dump Truck	Bulldozer	Excavator	Front End Loader	Grader
Skid Steer	Spreader Box	Vibratory Plate Compactor	Vibratory Steel Wheel Roller	Wheel Tractor Scraper
Hand Tools:				
Hand Tamper	Paving Lute	Shovel		
Testing/Inspection:				
12-foot Straight Edge	Engineer Folding Ruler	Measuring Wheel	Proctor Test Equipment	Shovel
Smart Level	Tape Measure			

Construction Methods

For rigid pavement, a course of 2A aggregate is placed to a minimum compacted depth of 3 inches directly on the subgrade. A course of OGS aggregate is placed on top of the 2A aggregate to a minimum compacted depth of 4 inches. The typical sections of the contract drawings show the required depth of the subbase.

For flexible pavement, each layer of 2A aggregate is placed to a compacted depth no greater than 8 inches. The typical sections of the contract drawings show the required depth of the subbase.

Measuring & Payment Methods

This item is usually paid for by the square yard, based on field measurements. In some cases, the subbase may also be paid by the cubic yard or ton.

Payment for the subbase is 75 percent of the estimated material payment amount until subsequent pavement is placed, which usually occurs for the subbase paid for by the square yard. Once the subbase is covered with the next pavement course, the remaining 25 percent is paid.

2. CEMENT-TREATED PERMEABLE BASE COURSE (SEC. 303)

This section addresses the placement of Cement-Treated Permeable Base Course (CTPBC) on a prepared surface. If the course is placed on a subgrade, the work includes the preparation of the subgrade.

☐ Review  Documentation Required

BEFORE CTPBC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and quality control (QC) plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Verify the condition of the previous subbase or subgrade is acceptable.	

DURING CTPBC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the subbase is conditioned to a moist condition to avoid excessive absorption.	
☐ 	Verify the use of an approved asphalt paver or mechanical spreader per the specification.	
☐ 	Ensure an 8- to 10-ton steel wheeled roller is used for compaction. Ensure a minimum of one pass with the roller. Do not exceed one hour between the time of batching and compaction.	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Check surface tolerance and depth for conformance to specifications.	
☐ 	Verify curing is placed immediately after compaction.	

AFTER CTPBC CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure curing is maintained according to PUB 408 Section 303 specifications.	
☐		Verify the newly placed course is protected for a minimum of three days from construction traffic.	
☐		Ensure the curing period is extended by an additional 24 hours if the curing temperature falls below 40 degrees.	
☐		Verify the material is removed and replaced if the curing temperature falls to 32 degrees or less within 72 hours of placement.	
☐		Confirm the depth is checked every 3,000 square yards.	

Material & Equipment

Materials for the work include an approved cement-treated aggregate mixture and a white membrane curing compound or white polyethylene sheeting material used for curing.

The cement-treated permeable base consists of Type 1 or Type 2 cement, Type A or Type B coarse aggregate, and water. These materials must meet the requirements outlined in PUB 408 Section 303. The cement-treated permeable base must be supplied by an approved cement concrete batch plant listed on the contractor's approved material source of supply and mixed according to an approved mix design.

The contractor uses an asphalt paver equipped with a vibrating screed, track lines that operate outside of the freshly placed CTPBC, a vibratory plate compactor, and fully automated sensors to control profile and transverse grades. Vibratory steel wheel rollers that meet the requirements of PUB 408 Section 303 are also used in constructing the permeable base course.

Mechanical:				
Asphalt Paver with Vibrating Screed	Concrete Mixer Truck	Concrete Saw	Tri-Axle Dump Truck	Vibratory Plate Compactor
Vibratory Steel Wheel Roller				
Hand Tools:				
Concrete Rake	Concrete Sprayer	Shovel		

Section 300: Base Courses

Testing/Inspection:				
10-foot Straight Edge	Core Drill	Engineer Folding Ruler	Measuring Wheel	Tape Measure

Construction Methods

In advance of placing the CTPBC, the contractor thoroughly sprinkles the subbase, including rubblized pavement, with water to ensure that the surface will not absorb water from the CTPBC. The contractor places the CTPBC using a paver or mechanical spreader, meeting the requirements outlined in PUB 408 Section 303. The base course is then compacted with a steel wheel power roller as specified in PUB 408 Section 303.

Immediately after compaction, the base course is covered with a white membrane curing compound or polyethylene sheeting for curing, as specified in PUB 408 Section 303. The CTPBC is cured, as specified, for a minimum of three days before placing the subsequent lifts. Traffic is not permitted on the base course except for equipment required to place the next CTPBC lifts or pavement course.

The Inspector-in-Charge (IIC) checks surface tolerance and determines depth check locations using PUB 19 PTM 1 as specified in PUB 408 Section 303. For depth checks, the contractor drills a 6-inch-diameter test hole at each location, and the inspector measures the depth of the material. If the base is defective in depth, surface tolerance, or other defects, the inspector and the contractor follow the remediation procedures outlined in PUB 408 Section 303.

All work must be completed in strict accordance with the approved QC plans.

Measuring & Payment Methods

CTPBCs are paid by the square yard. The area of the work is field measured, with computations and payment shown on a PSA. The measured width for payment should not exceed the plan width unless authorized by a Department Representative.

3. SUPERPAVE ASPHALT MIXTURE DESIGN, STANDARD CONSTRUCTION, BASE COURSE (SEC. 313)

This section addresses Superpave asphalt mixture design, standard construction, and Hot-Mixed Asphalt (HMA) base courses. This base course consists of a layer or layers of hot-mixed, hot-laid asphalt material. This pavement course is a plant-mix HMA-base course prepared using a volumetric mixture design developed with the Superpave gyratory compactor.

☐ Review  Documentation Required

BEFORE SUPERPAVE BASE COURSE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Refer to PUB 8 Section 400.1 Standard Asphalt Paving Operation for additional before, during, and after asphalt paving checklist items.	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Obtain appropriate paperwork for the tack coat.	
☐ 	Ensure care is taken to avoid paving in the rain. If rain begins during paving operations, the contractor immediately calls the plant and halts production. The IIC or District Materials Engineer/Manager (DME/M) is consulted for further instructions.	

DURING SUPERPAVE BASE COURSE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the base course is not placed on a wet surface or if the air or surface temperature is 35F or lower.	
☐ 	If the indicated depth of a Superpave 25.0 mm asphalt base course is more than 6 inches, ensure the asphalt base course is placed in two or more layers of approximately equal compacted depth, with no layer less than 3 inches or more than 6 inches.	

Section 300: Base Courses

☐		Task	Reference
☐		If the indicated compacted depth of a Superpave 37.5 mm asphalt base course is more than 8 inches, ensure the asphalt base course is placed in two or more layers of approximately equal compacted depth, with no layer less than 4 inches or more than 8 inches.	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure that the contractor avoids material segregation and that care is taken to keep the paver moving at a constant speed. The paving machine operator should keep the augers in the rear of the paver adequately covered.	
☐		Obtain material temperatures with calibrated stick thermometers through 3/8-inch holes in the truck to ensure that the temperature is in the range specified in PUB 408 Section 413.	
☐		Determine the test location by using PUB 19 PTM 1 for depth tests as specified in PUB 408 Section 313.	
☐		Refer to PUB 408 Section 413 and PUB 8 Section 400.1.K Testing Asphalt for test methods and lot/sublot information for density tests.	
☐		Check the uncompacted depth periodically to ensure proper compacted depth will be obtained.	
☐		Calculate weight per square yard to verify yield. It is particularly important to monitor the yield to make sure that in a tonnage payment, too much asphalt is not being placed, which could significantly increase the cost of the project, and for square yard payments, to make sure the contractor is meeting the minimum allowed thickness, which could lead to premature pavement failures. Refer to PUB 8 Example Calculations .	

AFTER SUPERPAVE BASE COURSE CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The material required to produce the Superpave HMA base course must meet the requirements of PUB 408 Section 413, be supplied by an approved asphalt batch plant as listed on the contractor's approved source of supply, and be mixed using an approved asphalt mix design. The contractor must supply the IIC with a copy of the asphalt material vendor's bill of lading. The bill of lading should contain all the required information outlined in PUB 408 Section 702. The

Section 300: Base Courses

contractor must also supply a certificate of analysis and a certification of compliance (Form CS-4171), as specified in PUB 408 Section 106. The contractor will submit their QC plan for Department approval. This plan must be approved before beginning paving operations.

The vehicles used to deliver the Superpave HMA base course to the project must be sealed tightly with covers sized to protect the entire load. When the air temperature is below 50F, all sides of the truck body should be insulated, double-walled, or heated.

In constructing the base course, the contractor uses an asphalt paver equipped with a vibrating screed and fully automated sensors to control grade. Vibratory steel wheel rollers are also used. The contractor uses an asphalt paver that is self-contained and power-propelled, with activated screeds or strike-off assemblies and automatic screed controls, meeting all other requirements of PUB 408 Section 413. Rollers used to compact the base course must meet the requirements of PUB 408 Section 108.

The contractor and the inspector need a calibrated thermometer to check the temperature of the material when it arrives on the project to ensure it is within specifications. The contractor also needs a nuclear gauge to check the density of the compacted base course.

Mechanical:				
Asphalt Paver with Vibrating Screed	Pave Auger	Skid Steer	Tri-Axle Dump Truck	Vibratory Plate Compactor
Vibratory Steel Wheel Roller				
Hand Tools:				
Hand Tamper	Paving Lute	Shovel		
Testing/Inspection:				
12-foot Straight Edge	Core Drill	Depth Check Gauge	Engineer Folding Ruler	Infrared Thermometer
Measuring Wheel	Nuclear Gauge	Probe Thermometer	Tape Measure	

Construction Methods

The Superpave HMA base course material is delivered in vehicles meeting the requirements of PUB 408 Section 413. Temperature checks are performed using calibrated probe thermometers through a 3/8-inch hole in the truck bed for compliance with PUB 408 Section 413. The material is then dumped into the paver hopper or material transfer unit.

The paver places the asphalt material on the plan grade and cross slope in lifts as specified in PUB 408 Section 313. The material is then compacted to the required density using rollers meeting the requirements of PUB 408 Section 108. Using a nuclear gauge or electrical impedance gauge, the contractor's technician establishes an optimum rolling pattern, following the procedures outlined in PUB 19 PTM 402 or PTM 403. Density is accepted by core sampling, the

Section 300: Base Courses

establishment of an optimum rolling pattern, or by visual non-movement under the compaction equipment based on PUB 408 Section 413.3 requirements.

The IIC determines depth check locations using PUB 19 PTM 1 as specified in PUB 408 Section 313. For depth checks, the contractor drills a 6-inch-diameter test hole at each location, and the inspector measures the depth of the material according to PUB 19 PTM 737. If the base is defective in depth by $\frac{1}{2}$ inch or more, the inspector and the contractor follow the remediation procedures outlined in PUB 408 Section 313.

All required tests on the Superpave HMA base, as outlined in PUB 408 Sections 313 and 413, must be performed, and all work must be completed in strict accordance with the contractor's approved QC plans.

Measuring & Payment Methods

Superpave HMA base courses are paid by the square yard or ton. The area of the work is field measured, with computations and payment shown on a PSA. The measured width for payment should not exceed the plan width unless authorized by a Department Representative.

4. COLD RECYCLED ASPHALT BASE COURSE (SEC. 341)

This section addresses the on-grade construction and material processing of a Cold Recycled Asphalt Base Course (CRABC) that uses asphalt material combined with Recycled Asphalt Pavement (RAP), Recycled Asphalt Mixture (RAM), cement, or virgin aggregates. Construction typically includes milling to an indicated depth, adding and mixing emulsified asphalt, placing, compacting, and testing.

☐ Review  Documentation Required

BEFORE CRABC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Refer to PUB 8 Section 400.1 Standard Asphalt Paving Operation for additional before, during, and after asphalt paving checklist items.	
☐	Watch the recycling operation video.	Cold-in-Place Recycling
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Witness calibration of distributors.	
☐ 	Ensure weather conditions are in compliance with PUB 408 ; the mixture is not spread or placed if the base area is excessively wet or frozen, and work is performed only if the temperature is 45F or above.	

DURING CRABC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Collect the bill of lading for the asphalt material.	

Section 300: Base Courses

☐		Task	Reference
☐		Verify the existing pavement is milled to produce RAP meeting the 1¼ inch maximum size.	
☐		Verify the reclaimed material, aggregates, and bitumen are combined according to the mix design.	
☐		Ensure CRABCs are not placed from September 1 to April 30 in Districts 1-0, 2-0, 3-0, 4-0, 9-0, and 10-0, and from October 1 to April 30 in all other districts, unless directed by the Department.	
☐		Ensure an adequate quantity of the mixture is maintained to produce an acceptable finished surface.	
☐		Verify the compacted layers are between 2 and 5 inches in depth.	
☐		Witness the construction of a test strip of 400 square yards in accordance with PUB 19 PTM 402 under the guidance of a nuclear gauge operator to determine the maximum density.	
☐		Check milling depth at least once every 3,000 square yards of completed work. Where depth is deficient by more than ½ inch, verify corrections are made.	
☐		Check for surface tolerance and depth.	
☐		Verify that the base course is compacted to a minimum density of 96% of the average control strip density.	

AFTER CRABC CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the smoothness and accuracy of the grade transversely and longitudinally are tested using a 12-foot straight edge or template and that a 3,000 square-yard area is tested at three locations. Ensure that the area is corrected if the average of the minimum space exceeds ½ inch.	
☐		Verify the base courses are cured for two weeks or until the average moisture content is less than 2% before placing additional asphalt courses.	

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Material & Equipment

The materials used to produce the cold recycled base course must meet the requirements outlined in PUB 408 Section 341. The asphalt material would be one of the types listed in PUB 408 Section 341 and added to the reclaimed material per the approved mix design. All materials must be from the suppliers listed on the contractor's approved material source of supply. The contractor must supply a copy of the material certification (Form CS-4171) as specified in PUB 408 Section 106.

The contractor uses equipment capable of milling the existing pavement, mixing and placing the material, and automatically metering liquids with a variation of not more than plus or minus 2 percent by weight of liquids.

The contractor needs rollers meeting the requirements of PUB 408 Section 108 to compact the base material to the requirements of PUB 408 Section 341. The contractor also needs to construct a test strip according to PUB 19 PTM 402 and check the density of the compacted base course as specified in PUB 408 Section 341.

Mechanical:				
Asphalt Paver	Concrete Mixer Truck	Milling Machine	Skid Steer	Vibratory Plate Compactor
Vibratory Steel Wheel Roller				
Hand Tools:				
Hand Tamper	Paving Lute	Shovel		
Testing/Inspection:				
12-foot Straight Edge	Core Drill	Depth Check Gauge	Engineer Folding Ruler	Measuring Wheel
Nuclear Gauge	Probe Thermometer	Tape Measure		

Construction Methods

The contractor takes samples of the reclaimed material and performs testing to establish the mix design. At least three weeks before the planned start of the mixture production, the mix design is submitted to the DME/M for review. Refer to PUB 27 Bulletin 27 Chapter 2 for procedures.

The contractor uses equipment capable of processing the asphalt pavement material on grade, including the mixing and placing operations. The contractor uses a single or multiple-unit train of equipment to construct the CRABC.

The inspector measures the milled depth and records at least one measurement on a PSA for every 3,000 square yards to ensure the pavement is milled to the depth indicated. If the base is defective in-depth, the inspector and the contractor follow the remediation procedures outlined in PUB 408 Section 341.

Section 300: Base Courses

Using a nuclear gauge, the contractor's technician sets up a density control strip of approximately 400 square yards, according to PTM 402. Using the control strip, the technician determines the density required to compact the base course as specified in PUB 408 Section 341. If directed, the contractor checks the surface tolerance using a 12-foot straight edge as specified in PUB 408 Section 341.

The base course is cured and protected as specified in PUB 408 Section 341.

Measuring & Payment Methods

Payment for CRABCs is in three parts.

The recycled asphalt base course is paid for by the square yard. This area is field measured, with computations and payment shown on a PSA. The payment width should not exceed the plan width unless authorized by a Department Representative.

Coarse aggregate is paid by the ton for the total incorporated into the work and shown on the material delivery tickets.

Asphalt material is paid by the gallon for the total incorporated into the work, measured by an acceptable method.

Cement material is paid by the ton for the total incorporated into the work.

5. CENTRAL PLANT MIX COLD RECYCLED ASPHALT BASE COURSE (SEC. 342)

This section addresses the construction of a Central Plant Mixed Cold Recycled Asphalt Base Course (CPMCRABC) mix, using a combination of RAP, RAM, cement, or virgin aggregates mixed with asphalt material in a continuous or batch-type mixer.

☐ Review  Documentation Required

BEFORE CPMCRABC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Refer to Section 400.1 Standard Asphalt Paving Operation for additional before, during, and after asphalt paving checklist items.	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Ensure weather conditions are in compliance with PUB 408 ; the mixture is not spread or placed if the base area is excessively wet or frozen, and work is performed only if the temperature is 45F or above.	

DURING CPMCRABC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Collect the bill of lading for the asphalt material.	
☐ 	Verify the existing pavement is milled to produce RAP meeting the 1¼ inch maximum size.	
☐ 	Verify the reclaimed material, aggregates, and bitumen are combined according to the mix design.	

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☐		Task	Reference
☐		Ensure CRABCs are not placed from September 1 to April 30 in Districts 1-0, 2-0, 3-0, 4-0, 9-0, and 10-0, and from October 1 to April 30 in all other districts, unless directed by the Department.	
☐		Ensure an adequate quantity of the mixture is maintained to produce an acceptable finished surface.	
☐		Verify the compacted layers are between 2 and 5 inches in depth.	
☐		Witness the construction of a test strip of 400 square yards in accordance with PUB 19 PTM 402 under the guidance of a nuclear gauge operator to determine the maximum density.	
☐		Check milling depth at least once every 3,000 square yards of completed work. Where depth is deficient by more than ½ inch, verify corrections are made.	
☐		Check for surface tolerance and depth.	
☐		Verify that the base course is compacted to a minimum density of 96% of the average control strip density.	

AFTER CPMCRABC CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the base course is protected from marring, distortion, and other damage.	
☐		Ensure the smoothness and accuracy of the grade transversely and longitudinally are tested using a 12-foot straight edge or template and that a 3,000 square-yard area is tested at three locations. Ensure that the area is corrected if the average of the minimum space exceeds ½ inch.	
☐		Verify the base courses are cured for two weeks or until the average moisture content is less than 2% before placing additional asphalt courses.	

Material & Equipment

The materials used to produce the cold recycled base course must meet the requirements outlined in PUB 408 Section 341. The asphalt material would be one of the types listed in PUB 408 Section 341 and added to the reclaimed material per the approved mix design. All materials

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must be from the suppliers listed on the contractor's approved material source of supply. The contractor must supply a copy of the material certification (Form CS-4171) as specified in PUB 408 Section 106.

To haul the material from the central mix plant, the contractor must use vehicles that are clean, tight, and, if required, have protective covers. The contractor needs mixing equipment that conforms to PUB 242 Chapter 5 and can mix the pulverized reclaimed material and additive into a homogeneous mixture.

An asphalt paver is used to place the material on a prepared surface to a uniform depth conforming to PUB 242 Chapter 5. Rollers meeting the requirements of PUB 408 Section 108 are used to compact the base course to the required density. The contractor also needs a nuclear gauge to establish and check the density of the compacted base course as specified in PUB 408 Section 341.

Mechanical:				
Asphalt Paver	Milling Machine	Mobile Mixer Plant	Skid Steer	Tri-Axle Dump Truck
Vibratory Plate Compactor	Vibratory Steel Wheel Roller	Wheel Loader		
Hand Tools:				
Hand Tamper	Paving Lute	Shovel		
Testing/Inspection:				
12-foot Straight Edge	Core Drill	Depth Check Gauge	Engineer Folding Ruler	Measuring Wheel
Nuclear Gauge	Probe Thermometer	Tape Measure		

Construction Methods

The contractor takes samples of the reclaimed material and performs testing to establish the mix design as specified in PUB 408 Section 341. At least three weeks before the planned start of mixture production, the mix design must be submitted to the DME/M for review.

The base course material is mixed at the central mix plant per the approved mix design and delivered to the project in vehicles meeting the requirements of PUB 408 Section 342. The material is then dumped from the hauling vehicles into the asphalt paver.

The paver places the base material at the indicated compacted depth. After placement, rollers are used to compact the base. Using a nuclear gauge, the contractor's technician sets up a density control strip of approximately 400 square yards according to PUB 19 PTM 402. Using the control strip, the technician determines the density required to compact the base course as specified in PUB 408 Section 341.

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The base course is cured and protected, and the surface is tested, as specified in PUB 408 Section 341. At the direction of the inspector, the contractor tests the base course depth as specified in PUB 408 Section 342.

The IIC determines depth check locations using PUB 19 PTM 1 as specified in PUB 408 Section 342. The inspector will designate one test location for each 3,000 square yards, and, at these locations, the Department Representative suspects the depth is deficient. At each test location, record one depth measurement. If the base is defective in-depth, the inspector and the contractor follow the remediation procedures outlined in PUB 408 Section 342.

Measuring & Payment Methods

CRAB is paid by the square yard or ton. The area is field measured, with computations and payment shown on a PSA or by the amount incorporated into the work based on delivery tickets received from the plant. The payment for width should not exceed the plan width unless authorized by a department representative.

Coarse aggregate is paid by the ton for the amount incorporated into the work, as shown on the delivery tickets.

Asphalt material is paid by the gallon for the amount incorporated into the work as measured by an acceptable method.

Cement material is paid by the ton for the amount incorporated into the work.

6. ASPHALT-TREATED PERMEABLE BASE COURSE (SEC. 360)

This section addresses the construction of an Asphalt-Treated Permeable Base Course (ATPBC) on a prepared surface. If placed on the subgrade, this work includes the preparation of the subgrade.

☐ Review  Documentation Required

BEFORE ATPBC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Refer to Section 400.1 Standard Asphalt Paving Operation for additional before, during, and after asphalt paving checklist items.	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Ensure weather conditions are in compliance with PUB 408 Section 360; the mixture is not spread or placed if the base area is excessively wet or frozen, and work is performed only if the temperature is 45F or above.	

DURING ATPBC CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Ensure the mixture is placed in compacted lifts of a maximum of 4 inches.	
☐	Verify automated sensors are used to control transverse grade and profile.	
☐ 	Confirm lifts have cooled to 100F before placing the next lift.	
☐ 	Ensure the vibratory roller is operated in static mode only.	

Section 300: Base Courses

☐		Task	Reference
☐		Verify that four roller passes are performed to compact the material. Compaction occurs only when the mat has cooled enough to prevent shoving or lateral movement.	
☐		Confirm the aggregate is not crushed with compaction.	
☐		Ensure ATPBC is placed to overlap the edge of previously placed adjacent lanes by 1 to 2 inches.	
☐		Verify that a vertical full-depth bulkhead is installed at the end of the day for any interruption of 30 minutes or more.	
☐		Confirm that first-day production testing is performed in accordance with PUB 408 Section 360 specifications.	
☐		Perform and monitor testing for depth, temperature, surface tolerance, transverse joints, and non-movement.	

AFTER ATPBC CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the finished surface at locations that appear irregular and at transverse joints and paving notches are tested using a 10-foot straight edge held in contact with the surface and parallel to the road centerline. In successive positions, the pavement surface is tested from one side to the other. The straight edge is advanced to the next location by moving it along the pavement centerline by no more than 5 feet. Irregularities of more than ½ inch are corrected by loosening the surface and removing or adding the mixture.	
☐		Verify the contractor protects the surface from damage and does not allow traffic on the ATPBC.	
☐		Ensure ATPBC deficient in surface tolerance, depth, or asphalt content is removed or replaced.	

Material & Equipment

Materials for the work include approved asphalt cement, Class Performance Grade (PG) 64S-22, as well as coarse and fine aggregates. The materials used to produce ATPBC must meet the requirements outlined in PUB 408 Section 360. These include asphalt cement class PG 64S-22, coarse aggregate Type A, fine aggregate Type A or Type B, hydrated lime, and a heat-stable anti-stripping additive. These materials must be mixed as specified in PUB 408 Section 360 and

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approved mix designs. All material must be from the suppliers listed on the contractor's approved source of supply. The contractor must supply a copy of the material certification (Form CS-4171) for the materials used as specified in PUB 408 Section 106 before making payment for the work.

The material is hauled to the project site in vehicles, such as dump trucks, which are clean, tightly sealed, and have protective covers.

The contractor uses a self-contained and power-propelled paver with activated screeds or activated strike-off assemblies and automatic screed controls. The paver should be capable of spreading and finishing the mixture to the width and depth indicated and meet all other requirements specified in PUB 408 Section 413. The contractor can also use an asphalt paver to place the base course. Vibratory steel wheel rollers with a manufacturer's certified mass weight of 8 to 10 tons, as specified in PUB 408 Section 360, are used to compact the base.

The contractor and the inspector need calibrated thermometers to check the temperature of the material when it arrives on the project to ensure it is within specifications for the PG 64S-22 asphalt cement and PUB 408 Section 360.

Mechanical:				
Asphalt Paver with Vibrating Screed	Skid Steer	Tri-Axle Dump Truck	Vibratory Plate Compactor	Vibratory Steel Wheel Roller
Hand Tools:				
Hand Tamper	Paving Lute	Shovel		
Testing/Inspection:				
10-foot Straight Edge	Core Drill	Depth Check Gauges	Engineer Folding Ruler	Measuring Wheel
Nuclear Gauge	Probe Thermometer	Tape Measure		

Construction Methods

The base material is hauled to the project site in vehicles meeting the requirements of PUB 408 Section 413. Temperatures are taken through holes drilled in the truck beds, and then the material is dumped into the asphalt paver or mechanical spreader.

A paver or mechanical spreader places the material using automatic screed controls to provide the indicated cross slope and depth and automated sensors to control the profile and transverse grade. The material is placed in a maximum of 4 inches of compacted lifts and cooled to 100F before placing the next layer or pavement course.

After the material has sufficiently cooled, the contractor rolls the base with a steel wheel roller in static mode, as specified in PUB 408 Section 360, to prevent shoving or lateral movement. The base course is compacted until it supports the weight of the paving equipment and is sufficiently stable to avoid shoving or lateral movement.

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The surface tolerance is checked with a 10-foot straight edge, as specified in PUB 408 Section 360. The base course is protected, and the asphalt-treated base course is checked for depth as specified in PUB 408 Section 360.

The IIC determines depth check locations using PUB 19 PTM 1 as specified in PUB 408 Section 360. For depth checks, the contractor digs or drills a 6-inch-diameter test hole at each location, and the inspector measures the depth of the material. If the base is defective in depth by $\frac{1}{2}$ inch or more, the inspector and the contractor follow the remediation procedures outlined in PUB 408 Section 360.

Measuring & Payment Methods

ATPBC is paid by the square yard or ton. The area is field measured, with computations and payment shown on a PSA. The width payment should not exceed the plan width unless authorized by a Department Representative.

The asphalt-treated permeable base may also be paid by the ton for the total incorporated into the work, as shown on the delivery tickets.

REFERENCES

Approved Quality Control Plans – [PPCC](#)

Approved Mix Designs – [ECMS](#)

[CS-4171](#) Certificate of Compliance Form

[PUB 2](#) Project Office Manual

- Appendix A, Soil and Earthwork Forms (Report on Compaction Density Non-Movement Form TR-478A)

[PUB 19](#) Field and Laboratory Testing Manual

- PTM 1 (Probability Sampling)
- PTM 402 (Determining In-Place Density and Moisture Content of Construction Materials by Use of Nuclear Gauges)
- PTM 403 (Determining In-Place Density of Asphalt Concrete Using Electrical Impedance Measurement Methods)
- PTM 737 (Measuring the Thickness of Asphalt Concrete Courses)

[PUB 27](#) Asphalt Concrete Mixtures, Design Procedures, and Specifications for Special Asphalt Mixtures (Bulletin 27)

- Chapter 2 (Design and Control of Asphalt Mixtures Using a Modified Marshall Design Procedure)

[PUB 34](#) Aggregate Producers (Bulletin 14)

[PUB 213](#) Temporary Traffic Control Guidelines

[PUB 242](#) Pavement Manual Policy

- Chapter 5 (Asphalt Concrete Pavement Guidelines and Policies)

[PUB 408](#) Highway Construction Specifications

- Section 106 (Control of Material)
- Section 108 (Performance and Progress)
- Section 206 (Placement and Compaction of Embankment and Fill)
- Section 210 (Subgrade)
- Section 303 (Cement Treated Permeable Base Course)
- Section 313 (Superpave Asphalt Mixture Design, Standard Construction, Base Course)
- Section 341 (Cold Recycled Asphalt Base Course, Cold-in-Place)
- Section 342 (Cold Recycled Asphalt Base Course, Central Plant Mix)
- Section 350 (Subbase)
- Section 360 (Asphalt Treated Permeable Base Course)
- Section 413 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed Asphalt Courses with Percent within Limits and LTS Testing (PWL-LTS))
- Section 701 (Cement)
- Section 702 (Asphalt Material)
- Section 703 (Aggregate)

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SECTION 400: FLEXIBLE PAVEMENTS

GOALS

- Ensure the BEST possible riding surface is obtained for the motoring public.
- Ensure that EVERY area of the pavement is free from defects.
- Ensure that EVERY area of the pavement has been properly compacted.

ASPHALT PAVING SAFETY

- **Traffic Control:** Review devices and properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** An asphalt paving operation has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the contractor's supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Asphalt Materials:** Review proper emergency procedures as materials are extremely hot and can cause extreme injury.
- **Nuclear Gauge:** Ensure the operator is wearing a badge and safely storing the source rod prior to moving.

1. STANDARD ASPHALT PAVING OPERATION (SEC. 413 & 419)

This section addresses asphalt paving operations with Superpave Mixture Design, both standard and Restricted Performance Specification (RPS) or Stone Matrix Asphalt (SMA) Mixture Design, using plant-mixed asphalt, and is intended to provide a quick reference checklist to aid the inspector on-site before, during, and after the asphalt operation. It includes PUB 408 Sections 413 and 419. References are made to subsections within Section 400 to explain further and provide examples of calculations.

This work is for the different types of asphalt mixes and their uses.

Binder Course

The binder course sits between the final wearing surface and the base course, where its key function is to distribute the load to the base course.

Wearing Course

The wearing course is designed to accommodate the traffic load and to resist skidding, traffic abrasions, and weather.

Scratch Course

The scratch course is designed to eliminate imperfections in the existing surface and ensure proper density and compaction are achieved in the layers above.

Leveling Course

The leveling course is designed to provide a relatively uniform working platform for placing binder or wearing courses.

☐ Review  Documentation Required

BEFORE ASPHALT PAVING CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Watch applicable training videos for asphalt paving operations.	Construction Training Videos
☐		Verify that mix design and quality control (QC) plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Review mix and paving temperature requirements in the contractor's approved QC plan in PPCC .	
☐		Check PUB 408 Sections 413 or 419 for paving seasons and dates.	

Section 400: Flexible Pavements

☐		Task	Reference
☐		Check PUB 408 Section 413 for paving season extension requirements. Section 419 does not allow extensions.	
☐		Verify or calculate material testing locations for cores and loose boxes.	Testing Asphalt
☐		Review types and quantities of various equipment for operation in PUB 408 Section 108.05.	
☐		Verify existing pavement surface has a proper cross slope, base repairs have been completed, and there are no wheel ruts or soft spots. Discuss with the Inspector-in-Charge (IIC) and contractor.	Preparation of Existing Surface
☐		Verify density gauges are properly prepared and calibrated.	Testing Asphalt
☐		Verify that the existing roadway joints are painted with hot asphalt Performance Grade (PG) binder or two applications of tack adjacent to the new paving area.	
☐		If overlaying concrete roadway, make sure all transverse joints are clearly located and marked for overlay saw cuts. See PUB 408 Section 515.	

DURING ASPHALT PAVING CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify surface prep is complete: cold patch removed, cracks larger than 1/4-inch are sealed, and patches are complete. Record who approved the condition of the surface prior to asphalt release.	Preparation of Existing Surface
☐		Verify paving notches are properly cut or milled per PUB 72M RC Standard 28M.	
☐		Verify that the existing surface is clean and dry, and air and surface temperature is 40F or above.	Preparation of Existing Surface
☐		Verify proper application of tack coat was applied per PUB 19 PTM 747 on existing surfaces and previously placed courses, and tack has cured and turned black prior to paving. Refer to PUB 8 Example Calculations .	Asphalt Tack Coat

Section 400: Flexible Pavements

☐		Task	Reference
☐		Check equipment and components, such as auger extensions and truck tarps, for specification compliance.	
☐		Ensure fuel oil or other solvents that may damage the paving material are not carried on the paving equipment or used near the paving operations.	Operation of Paver
☐		Verify paver is set to the proper cross slope and depth prior to paving. The paver screed must be heated prior to paving.	Operation of Paver
☐		Verify the material delivery ticket matches the approved mix design, QC plan, and item of work being performed for proper Equivalent Single-Axle Loads (ESALs), PG asphalt grade, and Skid Resistance Level (SRL).	eTicketing
☐		Ensure material is being delivered in trucks that are completely covered and protected from contamination and heat loss.	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Verify the temperature of the material at the beginning of paving operations and randomly throughout the paving operation. The temperature checks are taken from one of the 3/8-inch diameter holes in each side of the truck using a probe thermometer. See PUB 2 Section C.4 for proper procedures. Record the temperature following District procedures.	eTicketing
☐		Check the cross slope of lanes and shoulders at the beginning of paving, during paving, and after compaction with a level to ensure it conforms to typical section details in the plans.	MCDocs
☐		Monitor the speed of the paver; if there are frequent stops, this should be brought to the supervisor's attention.	Operation of Paver
☐		Ensure areas not reached by the paver are handled correctly via hand tools. Rakes are not permitted.	Hand Spreading and Finishing
☐		Verify and witness loose box samples are collected per PUB 19 PTM 746 prior to any compaction. For federally-funded projects or projects on the National Highway System (NHS), Theoretical Maximum Specific Gravity Gaussian mixture model (Gmm) samples will also need to be taken at this time.	Testing Asphalt
☐		Witness the contractor's technician establish the optimum rolling pattern utilizing Form TR-4276B . The contractor may elect to use Nuclear Gauge (PUB 19 PTM 402) or Electronic Impedance (PUB 19 PTM 403).	Compacting Asphalt

Section 400: Flexible Pavements

☐		Task	Reference
☐		Ensure the optimum roller pattern is accomplished to provide uniform mat coverage.	Compacting Asphalt
☐		Ensure that the material has reached the required density per PUB 19 PTM 402 or PTM 403.	Compacting Asphalt
☐		Calculate weight per square yard to verify yield. It is particularly important to monitor the yield to make sure that in a tonnage payment, too much asphalt is not being placed, which could significantly increase the cost of the project, and for square yard payments, to make sure the contractor is meeting the minimum allowed thickness, which could lead to premature pavement failures. Refer to PUB 8 Example Calculations .	
☐		Record the starting and stopping locations of each truck on the material delivery ticket.	eTicketing
☐		Verify cross slope and loose depth checks performed by the contractor.	Checking Thickness of Mat
☐		Visually inspect the new asphalt mat for signs of deficiencies, such as segregation, dust balls, mat cracking, and uncoated aggregate. If present, take a photo and call the supervisor.	Preparation of Existing Surface
☐		Verify longitudinal joints between asphalt layers are offset by 6 inches.	Constructing Longitudinal Joints
☐		Verify transverse joints are properly marked for saw and seal. See PUB 408 Section 515.	
☐		Witness the contractor check joints with a 12-foot straight edge to ensure compliance with specifications.	Hand Spreading and Finishing
☐		Ensure longitudinal joints (width = 4") and curb gutter areas (width = 12") are sealed with PG 64S-22 after paving operations.	Constructing Longitudinal Joints

AFTER ASPHALT PAVING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 400: Flexible Pavements

☐		Task	Reference
☐		Traffic is not permitted on the newly placed pavement surface until the surface temperature is less than or equal to 140F. Verify using an infrared thermometer or surface thermometer.	
☐		Ensure core sample locations are identified and witnessed being taken, and the thickness of the layer is verified per PUB 19 PTM 737.	Testing Asphalt
☐		Ensure Form TR-447 is completed per PUB 2 Section B.8.2, and samples are shipped to the Laboratory Testing Section (LTS) or delivered to the Pony Express within three days. If Hands-On Local Acceptance (HOLA) is specified, ensure that samples are delivered to the designated HOLA testing laboratory.	Sample ID Testing Asphalt
☐		Verify asphalt delivery tickets support tonnage being paid based on yield calculations. Show tonnage of material wasted. Refer to PUB 8 Example Calculations .	eTicketing

Material & Equipment

The type and class of asphalt material are furnished as required by the applicable item in the contract. Asphalt material is mixed at a batch or drum plant, usually a commercial plant or occasionally a portable plant set up on a project. The asphalt material is produced in accordance with the mix design submitted by the producer and approved by the District Materials Engineer/Manager (DME/DMM), as well as the plant QC plan. The asphalt contractor will also submit a placement QC plan for approval.

When material is delivered to the project, each truck will have a delivery ticket (either computer generated or within the eTicketing app) noting items such as the contract number, state route and section, asphalt plant PUB 41 Bulletin 41 supplier code, county and District, material type and Job Mix Formula (JMF) number, date and time, quantity of material on the load, cumulative quantity of material delivered, and truck number. eCertification must be generated in eCAMMS within one working day and sent to the IIC in ECMS to certify the material.

In laying the pavement, the contractor utilizes asphalt pavers with activated screeds and automatic screed controls. Asphalt hauling equipment should be tightly sealed with covers of sufficient size and quality to protect the entire load. From October 1 to April 30, haul trucks must have insulation on all sides of the truck body, a double-walled truck body, or a heated truck body when the air temperature is below 50F. A 3/8-inch diameter hole near the center and approximately two-thirds the distance down from the top of the vehicular box on both sides must be provided to allow for asphalt mixture temperature checks. Rollers must be steel wheels, pneumatic tires, or vibratory or oscillating, meet the requirements of PUB 408 Section 108, and be operated according to the manufacturer's recommendation. The contractor's technician will determine the number and size of rollers to be used to achieve the required compaction by establishing a rolling pattern as specified in PTM 402 or PTM 403. By employing proper roller size, speed, and amplitude frequency, shoving and cracking of the pavement should be eliminated. For PUB 408 Section 419, the contractor is required to perform a Demonstration Test Strip in accordance with Section 419.3.

Section 400: Flexible Pavements

Inspectors must have a dial probe thermometer capable of reading 50F to 500F in five-degree increments or a calibrated digital probe thermometer capable of reading temperatures from -4F to 392F in one-degree increments to check the temperature of the asphalt material using a hole drilled into the side of the truck to ensure it is within the specifications shown in PUB 408 Section 413 prior unloading.

A 4-foot level is also required to check the cross slope of the new pavement to ensure it meets the plan's typical sections and cross sections. A 12-foot straight edge is also required to check the surface of the pavement and the profile at construction joints. This will ensure a smooth ride and that the surface is within the tolerances noted in PUB 408 Section 413.

The contractor may use a roto mill to mill paving notches and paving transitions in existing pavements per PUB 72M RC Standard 28M. The contractor uses a self-propelled paver with activated screeds and automatic screed controls capable of producing a finished surface of specified evenness. The texture must meet the requirements of PUB 408 Section 413.

Hand tools are used to place blacktop material in locations inaccessible to pavers. Shovels and lutes are used for moving and leveling blacktop placed by hand. The contractor is not allowed to use rakes when placing the blacktop. Using rakes will cause segregation of the asphalt mixture.

Overlays

Overlays consist of placing a binder or wearing course over existing pavements, as indicated by the contract drawings and specifications. Specifications for materials used in overlays are listed in PUB 408 Sections 410, 412, 413, and 419, depending on the type of material required by contract drawings.

Scratch & Leveling Courses

A scratch course is used to bring an uneven roadway surface to a consistent grade by filling in depressions such as wheel ruts.

A leveling course is used to adjust an existing asphalt roadway to a new cross slope. The cross slope is changed by placing a course of asphalt pavement with the depth varying transversely across the roadway. When viewing a cross section in the plans, a leveling course will look like a wedge.

Asphalt Patching

The contractor uses a concrete saw to cut the limits of the existing pavement where the patch is to be placed. Excavating equipment, such as a backhoe, gradall, and track excavator, is used to remove material. Dump trucks haul the excavated material to an approved waste area. A jumping jack compactor or vibratory plate compactor might be used to compact the subbase if it is disturbed. A roto-milling machine can also be used to remove existing pavement in the patch area.

The contractor applies a double application of tack or PG binder to the vertical edges of patches using a hand wand or a distributor truck. If a distributor truck is used, it must meet the requirements of PUB 408 Section 460.

A mechanical paver may be needed for larger asphalt patches. The paver must meet all the requirements of PUB 408 Section 413.

For smaller asphalt patches, the contractor may use hand tools, such as square shovels, lutes, and a straight edge. Rollers and hand tampers are used to compact material. Rollers must meet the requirements of PUB 408 Section 108.05.

Section 400: Flexible Pavements

Mechanical:				
Asphalt Paver	Asphalt Widener	Material Transfer Vehicle	Pneumatic Tire Roller	Tri-Axle Dump Truck
Vibratory Plate Compactor	Vibratory Steel Wheel Roller			
Hand Tools:				
Hand Tamper	Paving Lute	Shovel		
Testing/Inspection:				
12-foot Straight Edge	Depth Check Gauge	Infrared Thermometer	Measuring Wheel	Nuclear Gauge
Probe Thermometer	Smart Level			

Construction Methods

Traffic control is set up according to the project traffic control plan and PUB 213. The pavement surface is cleaned as directed and according to PUB 408 Section 413.

Prior to placing asphalt, the surface is cleaned of all loose and detrimental material.

A tack coat is applied to the existing roadway surface, and previously placed courses according to PUB 408 Section 460 specifications, including the vertical faces of longitudinal and horizontal joints, curbs, inlets, and gutters, are painted with PG binder asphalt.

The contractor sets the paver to the proper cross slope and depth, and the strike-off screed is heated.

The asphalt material is discharged from dump trucks or transfer units into the paver hopper. The paving joint (transverse/longitudinal) is checked with a 12-foot straight edge to ensure a smooth transition (as indicated in PUB 408 Section 413). The paver then places the asphalt material at the required pavement depth and cross slope.

The contractor's certified nuclear technician, using a nuclear gauge or electrical impedance gauge, establishes a rolling pattern for density as specified in PTM 402 or PTM 403. The number of rollers, as well as the number of passes each roller will make, are determined by the rolling pattern.

After the pavement is placed, the contractor and the inspector check the depth and cross slope directly behind the paver. Once rolling begins, the contractor's technician uses the gauge to ensure proper density. Once paving is complete, cores are taken at locations established by the inspector.

The new pavement surface temperature must be less than or equal to 140F before opening to traffic and equipment. To check for surface smoothness, the straightedge is slid along the pavement surface, not exceeding half its length at a time. To check for smoothness at a construction joint, the straightedge is laid longitudinally across the joint.

Scratch & Leveling Courses

The contractor uses the same methods for the placement of scratch and leveling courses as with other courses of asphalt. However, the compaction methods for these courses are different. In order to compact these thin, inconsistent layers of asphalt, the contractor will use a pneumatic roller. A pneumatic roller uses air-filled rubber tires instead of a steel drum for compacting the lift of asphalt.

Asphalt Patching

The areas to be patched are laid out by a Department Representative.

The limits of the area to be patched are cut with a concrete saw if excavating equipment is to be used for material removal. The use of a concrete saw ensures a vertical edge on the patches and protects the remaining pavement from damage that might be caused by excavating equipment. If a milling machine is used to remove the pavement, it will also create a vertical edge.

The material from the patch area is then excavated. The subbase is repaired and compacted, if necessary. The vertical edges of the pavement are tacked using an approved asphalt material as listed in PUB 408 Section 460. The asphalt material required by project plan documents is placed according to the contractor's approved QC plan and the requirements of applicable sections of PUB 408. Asphalt material is compacted as required by PUB 408 Sections 413 or 450 and according to the contractor's approved QC plan. The density of the asphalt material is checked either by the contractor's technician (using a nuclear gauge) or is accepted by visual non-movement under the compaction equipment, as noted in PUB 408 Section 413 or 450. The newly placed surface is not opened to traffic until the surface temperature is less than or equal to 140F.

Measuring & Payment Methods

Payment for tonnage items is based on the amount of material incorporated into the work, using the weight noted on the delivery tickets received from the asphalt trucks. Square yard items are field measured; computations must be shown on a Project Site Activity (PSA) or spreadsheet. Yield tests are performed to check the amount of material placed. Waste needs to be determined and agreed to with the contractor and deducted from the payment.

Square yard items can be paid progressively, based on construction station lengths. The final payment, adjusted for progress payments, is based on field measurements and computations. The pavement width measurement should not exceed the plan width unless authorized by a Department Representative.

Asphalt patches can be paid by the square yard, including sawing and excavating, or the excavation and patching material can be paid as individual units, depending on contract specifications. If asphalt patching is paid per square yard, the patches are field measured, and computations are shown on a PSA. If paid in units (e.g., Class 1 or 1B excavation), the excavated areas are field measured, with computations made in the cubic yard and payments included on a PSA. Asphalt material is paid by the ton, using the amount of material incorporated into the work as recorded on the delivery tickets.

A. REMOVAL OF EXISTING SURFACE COURSE (SEC. 490)

This subsection addresses the removal of an existing asphalt surface course using contractor-approved means and methods.

☐ Review  Documentation Required

BEFORE REMOVAL OF EXISTING SURFACE COURSE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify removal method and waste site are approved.	MCDocs PPCC

DURING REMOVAL OF EXISTING SURFACE COURSE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify limits of removal are per plan (width and depth).	MCDocs
☐ 	Review the existing base course after it has been cleaned and identify repair areas with the IIC. Take photos of the existing surface after the removal operation and attach them to the PSA or include them with project records.	Preparation of Existing Surface

AFTER REMOVAL OF EXISTING SURFACE COURSE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that the edges of the remaining asphalt surface were trimmed to a neat vertical line.	

Material & Equipment

Most commonly, the contractor uses an asphalt milling machine to remove an existing surface course. Another method the contractor may use is to saw cut the limits of pavement removal and use excavating equipment, such as a front end loader or gradall, to remove the surface course.

Mechanical:				
<u>Asphalt Milling Machine</u>	<u>Broom Truck</u>	<u>Front End Loader</u>	<u>Gradall</u>	<u>Skid Steer</u>
<u>Tri-Axle Dump Truck</u>				

Construction Methods

Various methods of removal may be utilized. The contractor may utilize a milling machine, front end loader, gradall, or other approved methods. Material removed is hauled to an approved waste area or a department-designated area. If, during the removal, the existing base or adjacent pavement surface is damaged, the contractor must repair the damage.

Measuring & Payment Methods

Refer to PUB 408 Section 490.4.

Removal of the existing surface course is paid for by the square yard. Square yard items are field measured; computations must be shown on a PSA or spreadsheet.

B. MILLING OF ASPHALT PAVEMENT SURFACE (SEC. 491 & 492)

This subsection addresses the removal of existing asphalt surfaces to the required depth and surface tolerances as specified in PUB 408 Sections 491 and 492. Section 491 will be a pay item for a specified uniform depth of removal or a variable depth item if the thickness being removed varies. If an improvement in surface qualities such as ride is desired, the item will be for profile milling in accordance with Section 492.

☐ Review  Documentation Required

BEFORE ASPHALT MILLING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify equipment, removal method, and waste site are approved.	MCDocs PPCC
☐ 	Verify the milling equipment used by the contractor produces a surface tolerance that meets the requirements in PUB 408 Section 413.3.	
☐ 	Verify the contractor has established and laid out the proper grade and cross slope per plan using a smart level.	MCDocs

DURING ASPHALT MILLING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify proper limits of removal per plan (width and depth).	
☐ 	Check the cross slope of the milled surface and depth to verify the area meets plan requirements. Use a 4-foot smart level and tape measure.	
☐ 	Verify the rate of milling does not tear the mat. Take photos of the existing surface and attach them to the PSA or include them with project records.	

AFTER ASPHALT MILLING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Check that the milling does not damage utility covers. If damage occurs to any utility covers, document the locations, take photos, and inform the contractor and your supervisor.	
☐		Ensure the finished surface is free of gouges, grooves, and ridges.	
☐		Measure the depth of the milled area using a device such as a tape measure or engineer ruler.	
☐		Verify overlay surface will be applied within seven calendar days of milling or in accordance with contract special provisions.	

Material & Equipment

The contractor needs a milling machine designed and built for milling existing asphalt pavements. The machine should have an automatic grade and slope control system, be capable of milling concrete patches, and meet all the requirements of PUB 408 Sections 491 or 492, whichever applies. The contractor may also need a survey instrument to establish finish grades.

Hauling equipment, including dump trucks or front end loaders, is used to remove milled material from the work area. The contractor uses a power broom to sweep the milled surface after the milling operation is complete.

The inspector needs a 4-foot level to check the cross slope of the milled pavement to ensure it meets plan requirements and a device, such as a tape measure or engineer ruler, to measure the depth of the milled area. A survey instrument may be required for the contractor to establish finish grades for the milling operation.

Mechanical:				
Asphalt Milling Machine	Broom Truck	Front End Loader	Skid Steer	Tri-Axle Dump Truck
Testing/Inspection:				
Engineer Folding Ruler	Smart Level	Survey Transit	Tape Measure	

Construction Methods

Variable depth milling involves milling existing asphalt pavement down to an existing concrete pavement or base course. Profile milling involves the milling of an existing pavement to establish a uniform profile and cross slope.

Section 400: Flexible Pavements

On both profile and variable depth milling operations, the contractor establishes milling control grades and marks these on the pavement or offset stakes.

The contractor uses a milling machine with automatic grade and slope controls to mill the pavement surface as required by the plan.

Measuring & Payment Methods

Refer to PUB 408 Sections 491 and 492.

The variable depth and set depth milling are paid by the square yard. Square yard items are field measured; computations must be shown on a PSA or spreadsheet.

C. PREPARATION OF EXISTING SURFACE (SEC. 413)

This subsection addresses the preparation of the surface prior to the delivery of asphalt material and the start of paving operations. The surface could be an existing concrete pavement, a new concrete pavement, a new asphalt base course, an existing asphalt pavement that has had base repairs and milling operations performed, or a previously placed course.

☐ Review  Documentation Required

BEFORE SURFACE PREPARATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch the Asphalt Paving Surface Preparation Training Video.	Construction Training Videos
☐ 	Ensure the existing course is inspected for cracks, faulty joints, and faulty drainage, and that the required patching is completed. If the base is rutted or has depressions of 1 inch or greater, a scratch course of binder or wearing may be required before asphalt placement. Take photos of the existing surface after the removal operation and attach them to the PSA or include them with project records.	

DURING SURFACE PREPARATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify all temporary ramping, unsuitable material, patches, and excess cracks or joint sealer are removed.	
☐ 	Verify all joints are cleaned and resealed.	

AFTER SURFACE PREPARATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Check the cross slope of the existing surface to verify the area meets plan requirements. Use a 4-foot smart level and tape measure.	
☐ 	Witness the contractor check the surface with a 12-foot straight edge for irregularities that may require correction. Document the location of any irregularities and take photos.	

Material & Equipment

Before delivering the asphalt, the contractor will remove and dispose of loose and foreign material and excess joint and crack sealer. A broom truck or vacuum truck is utilized.

Mechanical:				
Broom Truck	Vacuum Truck			
Testing/Inspection:				
12-foot Straight Edge	Smart Level			

Construction Methods**Conditioning of Existing Surfaces**

An asphalt material meeting the requirements of PUB 408 Section 413 may be applied to the existing vertical surfaces of curbs, structures, gutters, and pavements. A tack coat meeting the requirements of PUB 408 Section 460 is applied to existing surfaces and previously placed courses before overlaying.

Scratch & Leveling Courses

A scratch course is used to fill wheel ruts and other small local depressions with the surrounding pavement. Use a leveling course to provide a uniform surface for placing binders and wearing courses.

Paving Notches

Mill the existing pavement surface at tie-in locations of the wearing course as shown on Standard drawings. A milling machine would be used for this.

Measuring & Payment Methods

If required, the cleaning and sealing of existing joints and cracks are paid by the linear foot, using field measurements, and paid on a PSA.

If a scratch or leveling course is required, it is paid by the ton of material incorporated into the work, as shown on the delivery tickets.

D. ASPHALT TACK COAT (SEC. 460)

This subsection involves the conditioning and treating of an existing surface and previously placed courses with an application of emulsified asphalt bonding material.

☐ Review  Documentation Required

BEFORE ASPHALT TACK COAT APPLICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the existing surface is prepared per PUB 408 Section 413.3.	Preparation of Existing Surface
☐ 	Ensure a copy of the bill of lading for the asphalt material is obtained from the supplier before the material is applied.	
☐ 	Verify the distributor truck is equipped with all gauges required per PUB 408 Section 460 and calibrated.	

DURING ASPHALT TACK COAT APPLICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the temperature of the asphalt material in the distributor tank and that the temperature was within the min and max on the bill of lading and specifications.	
☐ 	Verify proper application of tack coat was applied on existing surfaces and previously placed courses, and tack has cured and turned black prior to paving per PUB 408 Section 460 and PUB 19 PTM 747. PUB 8 Example Calculations .	
☐	Ensure all uncoated, lightly coated, or excessively coated areas are corrected.	

AFTER ASPHALT TACK COAT APPLICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	If emulsified asphalt is used, confirm all water has evaporated after its application and prior to paving. Only pave after the emulsified asphalt has turned black.	
☐	Ensure the treated areas are protected and maintained until asphalt is placed.	

Material & Equipment

Refer to PUB 408 Section 413 for approved asphalts. If emulsified asphalt Class TACK or Non-Tracking Tack (NTT/CNTT) is used after the application and water has evaporated, the inspector should calculate the yield to determine if the TACK or NTT/CNTT was applied at the rate specified in Section 460 of PUB 408.

The distributor must be able to control the application rate within a tolerance of 0.02 gallons per square yard. The contractor may use hand-spraying equipment in areas inaccessible to the distributor.

Additional items needed include a device to measure linear feet, a 4-foot level, a dipstick for the tank, the manufacturer's certificate of calibration for the tank, and a tape measure or wheel.

Mechanical:				
Broom Truck	Distributor Truck			
Hand Tools:				
Hand Sprayer				
Testing/Inspection:				
Measuring Wheel	Smart Level	Tape Measure		

Construction Methods

The distributor truck is equipped with a tank containing tack material. The inspector receives a bill of lading for the tack from the asphalt supplier. Included in the bill of lading is the percent of asphalt in the TACK or NTT/CNTT.

Using PUB 19 PTM 747, the tank is leveled and the tack in the tank is measured. The amount in gallons is computed. After the surface is cleaned, a test strip is laid, per Table 1 in PTM 747, and the distributor applies tack to the area. The application rate is checked using the formulas noted

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in PTM 747. If the contractor uses an emulsified asphalt tack, the inspector should ensure that all the water has evaporated (turned black) before the asphalt pavement is placed.

Measuring & Payment Methods

Tack coat may be paid by the square yard or by the gallon. The application rate is checked according to PTM 747, and the area is field measured and computed to the square yard and recorded on a PSA.

If paid by the gallon, the distributor tank is measured per PTM 747, and the gallon applied is computed. The amount applied can also be determined by using the truck volume measuring device, but the device must be accurate.

E. OPERATION OF PAVER

This subsection addresses the operation of an asphalt paver.

☐ Review  Documentation Required

BEFORE PAVER OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Check the type and size of the paver to ensure that it meets all the requirements of PUB 408 Section 413.3.	
☐ 	Check that the automatic screed was activated and that the screed was kept hot during the paving operation.	
☐	Ensure that fuel oil or other solvents that may damage the paving material are not carried on the paving equipment or used near the paving operations.	

DURING PAVER OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the cross slope and mat thickness were verified at the beginning of paving and checked randomly throughout the paving operation.	Checking Thickness of Mat
☐ 	Verify the texture of the mat behind the paver is uniform.	

AFTER PAVER OPERATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the texture of the mat behind the paver is uniform.	

Material & Equipment

Pavers should be self-contained and power-propelled, with activated screeds and automatic screed controls capable of producing a finished surface of specified evenness and texture. The paver must meet all the requirements of PUB 408 Section 413.3.

The paver must be set at the required depth and cross slope at the beginning of the paving operation. Prior to compaction, the inspector should check the mat behind the paver for uniformity. If the mat is not uniform, the inspector should check the screed and make sure the screed is hot. The slow, continuous movement of the paver provides for a uniform riding surface. However, any adjustments to the paver are made by the contractor.

Mechanical:				
Asphalt Paver	Asphalt Widener			

Construction Methods

There are no construction methods for this operation.

Measuring & Payment Methods

There are no measuring and payment methods for this operation.

F. CHECKING THICKNESS OF MAT

This subsection addresses the measurement of asphalt pavement thickness before and after compaction.

☐ Review  Documentation Required

BEFORE CHECKING MAT THICKNESS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Calculate core locations per PUB 408 Section 413. Refer to PUB 8 Example Calculations .	
☐	Check that a measuring device capable of being inserted through the pavement mat is obtained.	

DURING CHECKING MAT THICKNESS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure depth checks taken by the contractor are witnessed.	
☐ 	Calculate weight per square yard to verify yield. It is particularly important to monitor the yield to make sure that in a tonnage payment, too much asphalt is not being placed, which could significantly increase the cost of the project, and for square yard payments, the contractor is meeting the minimum allowed thickness, which could lead to premature pavement failures. Refer to PUB 8 Example Calculations .	

AFTER CHECKING MAT THICKNESS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure core locations are identified and core drilling is witnessed.	

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☐		Task	Reference
☐		Ensure cores are measured using procedures outlined in PUB 19 PTM 737 and the results are documented in a PSA.	

Material & Equipment

An asphalt depth gauge is utilized during pavement operations to check the loose depth of the asphalt. It is a metal device, such as a manufactured device, metal rod, or other handmade metal probe. After the placement is complete, an asphalt coring machine is used to extract the cores for density and to check the compacted depth of the asphalt.

Mechanical:				
Asphalt Coring Machine				
Testing/Inspection:				
Depth Check Gauge				

Construction Methods

The contractor, using a measuring device inserted through the mat behind the paver, takes depth checks of the mat before and after compaction.

For courses with density acceptance, cores are taken by the contractor in accordance with the approved QC plan and are measured by the inspector according to PTM 737. For courses with acceptance by visual non-movement under compaction equipment for density, the inspector calculates the weight per square yard for verification of yield.

The yield should be checked randomly throughout the paving operation.

Measuring & Payment Methods

There are no measuring and payment methods associated with this item.

G. HAND SPREADING & FINISHING (SEC. 413)

This subsection addresses the spreading and finishing of asphalt material with hand tools. The contractor should plan standard asphalt placement operations to minimize hand spreading and finishing per PUB 408 Section 419 specifications.

☐ Review  Documentation Required

BEFORE HAND SPREADING & FINISHING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure tools that are used meet the requirements of PUB 408 Section 413. Rakes are not permitted.	
☐ 	Verify the temperature of the material prior to placement.	

DURING HAND SPREADING & FINISHING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Check labor and equipment used in the operation.	
☐ 	Ensure that the material placed in areas not accessible to paving equipment is placed by hand.	
☐	Ensure that the cross slope is verified with a 12-foot straight edge before compaction and that depth checks are verified for the material being placed.	
☐ 	Perform depth checks prior to compaction and record the results.	
☐ 	Ensure the material is compacted.	
☐ 	Document station-to-station, lane, direction, and where the work is performed.	

AFTER HAND SPREADING & FINISHING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The inspector will need a 4-foot level to check the cross slope of the pavement as well as a 12-foot straight edge to check the new pavement profile.

Mechanical:				
Skid Steer				
Hand Tools:				
Paving Lute	Shovel			
Testing/Inspection:				
12-foot Straight Edge	Smart Level			

Construction Methods

In spreading and finishing asphalt pavements, hand tools are only to be used in areas where mechanical spreading cannot be performed.

The contractor places the material by end dumping it into position or by using equipment such as a front end loader. The material is then shoveled and hand-luted into position.

Before rolling, the material is checked with a 12-foot straight edge and a 4-foot level for profile and cross slope. When the material is spread by hand, a greater allowance is made for the reduction of thickness during compaction. After the material is placed and checked, the contractor compacts the material with a vibratory plate or a hand tamper.

Measuring & Payment Methods

This work is incidental to the material placed.

H. COMPACTING ASPHALT

This subsection addresses the compaction of a binder and wearing course.

☐ Review  Documentation Required

BEFORE ASPHALT COMPACTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Check that the rollers meet the requirements of PUB 408 Section 108.	
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs

DURING ASPHALT COMPACTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the contractor's technician establishes a rolling pattern with a nuclear gauge, using the procedures outlined in PUB 19 PTM 402 or PTM 403, to determine the number of rollers, amount of roller passes, and types of rollers.	
☐ 	Ensure that the material is rolled using the established rolling pattern.	
☐	Ensure that the breakdown roller stays close to the paver. Rubber-tired rollers are typically used for scratch-leveling courses.	
☐ 	Ensure that the material has reached the required density per PUB 19 PTM 402 or PTM 403.	

AFTER ASPHALT COMPACTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure core sample locations are identified and witnessed being taken, the thickness of each layer is measured using procedures outlined in PUB 19 PTM 737, and the results are documented in a PSA.	
☐ 	Ensure Form TR-447 is completed per PUB 2 Section B.8.2, and samples are shipped to the LTS or delivered to the Pony Express within three days. Hands-on Local Acceptance (HOLA) refers to the QC plan in PPCC .	Sample ID Testing Asphalt

Material & Equipment

Rollers must be steel wheels, pneumatic tires, or vibratory, meet the requirements of PUB 408 Section 108, and be operated according to the manufacturer's recommendation. The contractor's technician will determine the number and size of rollers to be used to achieve the required compaction by establishing a rolling pattern as specified in PUB 19 PTM 402 or PTM 403. By employing proper roller size, speed, and amplitude frequency, shoving and cracking of the pavement should be eliminated. For PUB 408 Section 419, the contractor is required to perform a demonstration test strip in accordance with Section 419.3.

Mechanical:				
Pneumatic Tire Roller	Vibratory Plate Compactor	Vibratory Steel Wheel Roller		

Construction Methods

After the pavement is placed, the rolling operation begins directly behind the paver. The contractor's technician, using a nuclear gauge or electrical impedance gauge and information from the QC paving plan, establishes a rolling pattern following the procedures outlined in PTM 402 or PTM 403. This procedure ensures that the required density is achieved. The number, type, and number of roller passes are established by the rolling pattern.

The transverse joint is pinched with a roller, which is placed approximately 4 inches onto the uncompacted material from the existing pavement and operates parallel to the transverse joint. The initial roll across the joint parallel to the pavement centerline should be done slowly with a tandem roller, with a first pass of 3 to 4 feet. Roller pass overlays should be one-half the width of the roller.

For longitudinal joints, the roller should extend 3 to 6 inches out from the unsupported edge on both sides of the first lane placed. When the second lane (abutting lane) is placed, the paver should be overlapped 1 to 1½ inches onto the first lane to ensure material is forced into the joint by the paver augers. No luting or bumping should occur at the joint. Compaction should start on the outside unsupported edge with a 3 to 6-inch overlap, with each subsequent pass proceeding

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toward the joint. The next-to-last roller pass should leave 6 to 12 inches (18 inches for a notch wedge) of uncompacted material at the joint. On the first pass over the joint, the roller should overlap the previously placed lane by 2 to 6 inches. The joint should then receive at least as many passes as required by the optimum rolling pattern, with each pass overlapping the previously placed lane by 2 to 6 inches.

Traffic is not permitted on the pavement until the surface temperature is below (140F).

Measuring & Payment Methods

This work is incidental to the type of material placed.

I. CONSTRUCTING LONGITUDINAL JOINTS

This subsection addresses the construction of longitudinal joints in asphalt paving.

☐ Review  Documentation Required

BEFORE CONSTRUCTION OF LONGITUDINAL JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Watch the Asphalt Pavement Longitudinal Joints training video for asphalt paving operations.	Asphalt Training Videos

DURING CONSTRUCTION OF LONGITUDINAL JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the contractor constructed the joints following the procedures of the approved QC plan.	
☐ 	Ensure that a nearly vertical edge or a notched wedge exists per RC Standard 28M.	
☐	Ensure that joints are offset (6 inches) from the joint in the layer immediately below. The top joint is at the approximate pavement centerline or within 12 inches of pavement markings, not under the pavement markings and out of the wheel path. If possible, the top joint should also be directly over the underlying concrete joint.	
☐ 	Check the joint with a string line or straight edge to ensure it meets the specifications outlined in PUB 408 Section 413.3.	
☐	Ensure that the tack coat extends 6 inches beyond the joint on the first lane placed.	

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☐		Task	Reference
☐		Ensure that a coat of asphalt material, meeting the requirements of PUB 408 Section 413.3, was applied to the joint before the abutting lane was placed.	
☐		When placing the abutting lane, ensure the paver is only overlapped 1 to 1½ inches onto the previously placed lane and that the joint is compacted properly.	
☐		Ensure that the joint is rolled to ensure that it is closed and properly compacted.	

AFTER CONSTRUCTION OF LONGITUDINAL JOINTS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Obtain core samples for testing as required per the specification and PUB 408 Section 405.	
☐		Ensure joints are sealed with hot PG 64S-22 asphalt binder.	

Material & Equipment

The contractor uses an asphalt paver and rollers, meeting the requirements of PUB 408 Section 413. The rollers must meet the requirements of PUB 408 Section 108.

A 12-foot straight edge is used to verify that the joints are smooth and uniform.

Mechanical:				
Asphalt Paver	Automatic Joint Matcher			
Testing/Inspection:				
12-foot Straight Edge				

Construction Methods

Longitudinal joints are offset about 6 inches from the joint in the layer immediately below. Plan joint locations should be calculated to ensure that the joint in the top layer is at approximately the pavement centerline or within 12 inches of the planned pavement markings and not in the wheel path. If possible, the top joint should also be directly over the underlying concrete joint.

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Vertical joints may be used in base, binder, and wearing courses. The abutting lane should be placed on the same day, if possible.

A notched wedge joint can be used on binder and wearing courses if the maximum aggregate size is less than 19 millimeters. The joint should be constructed in accordance with RC standards.

The abutting lane joint is painted with asphalt material as specified in PUB 408 Section 413.

The roller should extend 3 to 6 inches out from the unsupported edge on both sides of the first lane placed. When the second lane (abutting lane) is placed, the paver should be overlapped 1 to 1½ inches onto the first lane to ensure material is forced into the joint by the paver augers. No luting or bumping should occur at the joint. Compaction should start on the outside unsupported edge with a 3 to 6-inch overlap, with each subsequent pass proceeding toward the joint. The next-to-last roller pass should leave 6 to 12 inches (18 inches for a notch wedge) of uncompacted material at the joint. On the first pass over the joint, the roller should overlap the previously placed lane by 2 to 6 inches. The joint should then receive at least as many passes as required by the optimum rolling pattern, with each pass overlapping the previously placed lane by 2 to 6 inches.

Measuring & Payment Methods

This work is incidental to the type of material placed.

J. CONSTRUCTING TRANSVERSE JOINTS

This subsection addresses the construction of transverse joints in asphalt pavements.

☐ Review  Documentation Required

BEFORE CONSTRUCTION OF TRANSVERSE JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs

DURING CONSTRUCTION OF TRANSVERSE JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the contractor constructed the joints following the procedures of the approved QC plan.	
☐ 	Ensure that a nearly vertical edge is constructed.	
☐ 	Ensure that a coat of asphalt material, meeting the requirements of PUB 408 Section 413, was applied to the joint before the abutting lane was placed.	
☐ 	Ensure that the material was not overlapped at the joint and that the joint was compacted.	
☐ 	Ensure that the joint is checked with a 12-foot straight edge to ensure it meets the specifications outlined in PUB 408 Section 413.	
☐ 	Ensure that the joint is rolled to ensure that it is closed and compacted.	

AFTER CONSTRUCTION OF TRANSVERSE JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure joints are sealed with hot PG 64S-22 asphalt binder.	

Material & Equipment

The contractor needs an asphalt paver and hand tools meeting the requirements of PUB 408 Section 413. Rollers must meet the requirements of PUB 408 Section 108.

The contractor also needs a 12-foot straight edge to check joints transversely and longitudinally, ensuring that they are smooth and uniform.

Mechanical:				
Asphalt Paver	Skid Steer	Vibratory Steel Wheel Roller		
Hand Tools:				
Paving Lute	Shovel			
Testing/Inspection:				
12-foot Straight Edge	Smart Level			

Construction Methods

A strip of roofing paper, burlap, or white plastic can be put down to make a joint at the end of the day's paving (this is called a papered joint). Asphalt material is then placed on the strip. With this method, rollers coming off the pavement will not damage or round the joint.

Immediately prior to paving, the excess material and plastic can be removed, and a vertical joint with a tack coat meeting PUB 408 standards is constructed. When starting to pave at a transverse joint on existing pavement, the contractor should place wooden blocks thick enough to allow for the compaction of the material on the existing pavement. The paver screed is then set down on the wooden blocks to start paving at the joint. As a rule of thumb, an asphalt material is expected to compact approximately 20% under compaction equipment. The thickness of the wooden blocks should be calculated using this 20% compaction rule.

The joint is pinched with a roller, which is placed approximately 4 inches onto the uncompacted material from the existing pavement and operates parallel to the transverse joint. The initial roll across the joint parallel to the pavement centerline should be done slowly with a tandem roller, with a first pass of 3 to 4 feet. Roller pass overlays should be one-half the width of the roller.

Measuring & Payment Methods

This work is incidental to the type of material placed.

K. TESTING ASPHALT

This subsection addresses tests for pavement density, pavement surfaces, and loose box samples.

☐ Review  Documentation Required

BEFORE TESTING ASPHALT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Compute locations and stations for loose box and core samples per PUB 19 PTM 1, PTM 729, and PTM 746 at the frequencies specified in PUB 408 Section 413. Refer to PUB 8 Example Calculations .	

DURING TESTING ASPHALT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the temperature of the material at the beginning of paving operations and randomly throughout the paving operation. The temperature checks are taken from 3/8-inch diameter holes in each side of the truck using a dial probe thermometer. See PUB 2 Section C.4 for proper procedures. Record the temperature following District procedures.	
☐ 	Verify and witness that loose box samples are collected per PUB 19 PTM 746, prior to any compaction. For federally funded projects, Gmm samples will also need to be taken at this time.	
☐ 	Ensure that station-to-station, lane, and direction of work and any defects are recorded.	
☐ 	Witness the contractor's technician establish the optimum rolling pattern utilizing Form TR-4276B . The contractor may elect to use Nuclear Gauge (PUB 19 PTM 402) or Electronic Impedance (PUB 19 PTM 403).	Compacting Asphalt
☐ 	Verify the pavement course is uniform and to grade and cross slope, ensuring a good ride quality on the wearing course surface.	

AFTER TESTING ASPHALT CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure core sample locations are identified and witnessed being taken and the thickness of the layer is verified per PUB 19 PTM 737.	

Material & Equipment

The contractor is required to have a nuclear gauge meeting the requirements of PUB 408 Section 413 to test for pavement density and to establish a rolling pattern (using procedures outlined in PUB 19 PTM 402 and PTM 403). The contractor also needs a core machine to remove 6-inch-diameter cores for density testing and depth checks.

The inspector needs a 12-foot straight edge to check the pavement profile for irregularities. Both the inspector and the contractor need a 4-foot level to check the cross slope of the newly placed pavement.

Inspectors must have a dial probe thermometer capable of reading 50F to 500F in five-degree increments or a calibrated digital probe thermometer capable of reading temperatures from -4F to 392F in one-degree increments to check the temperature of the asphalt material using a hole drilled into the side of the truck to ensure it is within the specifications shown in PUB 408 Section 413 prior unloading.

Mechanical:				
Asphalt Coring Machine				
Testing/Inspection:				
12-foot Straight Edge	Nuclear Gauge	Probe Thermometer	Smart Level	

Construction Methods

The contractor's technician uses a nuclear gauge or an electrical impedance gauge to establish a rolling pattern (following the requirements of PUB 19 PTM 402 or PTM 403) to ensure that the material is compacted to the required density.

The inspector selects the loose box and core samples according to PUB 19 PTM 1, PTM 729, and PTM 746 at the frequencies specified in PUB 408 Section 413. Samples are identified by the inspector and collected by the contractor's technician, with the inspector witnessing the collection of the samples. The samples are shipped by the inspector to the Materials Testing Division (MTD) for testing or to the identified test location if LTS utilizes secure shipment practices.

The surface of the pavement is checked with a 12-foot straight edge. The straight edge is placed on the pavement surface parallel to the roadway centerline and advanced in stages of not more than half the length of the straight edge. A string line can also be used to check the pavement

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profile, using a 50-foot string line and three wooden blocks of the same thickness. The string line is stretched across the top of two blocks placed 50 feet apart, while the third block is slid under the string to check for irregularities.

Measuring & Payment Methods

This work is incidental to the type of material placed.

2. EVALUATION OF ASPHALT PAVEMENT RIDE QUALITY (SEC. 404)

This section addresses evaluating an asphalt pavement surface and determining the ride quality incentive with the surface profile.

☐ Review  Documentation Required

BEFORE RIDE QUALITY TESTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 19 PTM 428 for test requirements.	MCDocs
☐ 	Verify operator is certified.	Certification List
☐	Verify roadway surface is clear of dirt and debris.	
☐ 	Ensure the Light Weight Profiler (LWP) PennDOT certification sticker is verified.	
☐ 	Calibration of the profiler witnessed for distance and profile.	
☐ 	Starting and stopping stations are verified.	

DURING RIDE QUALITY TESTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the joint is checked with a 12-foot straight edge to ensure it meets the specifications outlined in PUB 408 Section 413.	

AFTER RIDE QUALITY TESTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Record the following:	

□		Task	Reference
		• Equipment type • The PennDOT certification expiration date of the LWP • That the operator is certified per PUB 19 PTM 428 • Station-to-station where the profiler was run • The profile review for each lot for payment	

Material & Equipment

The contractor uses a LWP that has been verified by the Department. The profiler must be an all-terrain or golf cart type vehicle. In some instances, PennDOT may be running the profiler. Check the contract specifications for this case.

The pavement smoothness specification is based upon the International Roughness Index (IRI), which is an expression of the rideability of the roadway as experienced by vehicle passengers. IRI was developed as a reference measure by The World Bank and based on a quarter-car simulation as described in NCHRP Report 228.

IRI is determined with devices known as inertial profilers, or simply "profilers." Profilers are instruments used to measure road profiles. Typically, they are either high-speed profilers that travel at highway speeds, which PennDOT has been using for more than a decade, or LWP devices. An LWP is an off-road utility vehicle that can be easily used within the confines of construction projects due to its limited size and weight and added maneuverability. Both types of inertial profilers are usually mounted with laser sensors and computers.

PUB 19 PTM 428 defines the method by which to measure pavement profile and determine pavement ride quality for acceptance and payment using an LWP device. PennDOT wants to be assured that each individual LWP device is operated proficiently and provides accurate and precise results, which is why a program has been developed to verify that all LWP devices are calibrated and operating properly.

The program also includes certifying that LWP operators are capable of operating the device, as well as collecting, analyzing, and reporting accurate results. The certification program ensures control of the use of LWP devices, promotes competence, proficiency, and professionalism, and increases confidence in the test data. Operator certification is necessary because PennDOT offers no training for LWP operations. The vendors that supply LWP devices may provide training, but the extent and quality of training are beyond PennDOT's control and will vary depending on the vendor, device type, and software of each LWP device.

All LWP devices with acceptable test results will be designated with a decal to be applied by the Roadway Inventory Testing Unit, and all certified LWP operators will be provided a certification card.

The profiler is calibrated each day for distance and profile; this activity should be witnessed.

Mechanical:				
Pavement Profile Grinder				

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Testing/Inspection:				
12-foot Straight Edge	High-Speed Profiler	Light Weight Profiling System		

Construction Methods

Refer to PUB 19 PTM 428 for instructions on profiler operation.

The contractor must provide traffic control, and all objects and equipment must be removed from the surface to accommodate testing. Sweep the surface as necessary to remove debris.

The profiler starts 100 feet before the area that is to be tested. The profiler makes a pass on the right wheel path and the left wheel path of each travel lane, traveling through the test area and 100 feet beyond the test area. An average is calculated from the results of the two runs. Some profilers run both wheel paths at the same time.

Measuring & Payment Methods

A full lot size is 528 feet of a single pavement lane, which is noted in PUB 408 Section 404. After the contractor runs the profiler, profile readings will be given to the IIC. Payment is made according to PUB 408 Section 404.

3. EVALUATION OF ASPHALT PAVEMENT LONGITUDINAL JOINT DENSITY & PAYMENT OF INCENTIVE/DISINCENTIVE (SEC. 405)

This section addresses the evaluation of asphalt pavement longitudinal joint samples on the surface wearing course for determining densities and the incentive/disincentive.

☐ Review  Documentation Required

BEFORE EVALUATION OF LONGITUDINAL JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Compute locations for core samples per PUB 19 PTM 1 and PTM 729 at the frequencies specified in PUB 408 Section 405.	

DURING EVALUATION OF LONGITUDINAL JOINTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure lots are designated as the longitudinal joints are constructed, beginning on the first day wearing course paving abuts a previously placed wearing course, forming a longitudinal joint.	
☐ 	Ensure a QC strip is performed by obtaining five 6-inch-diameter core samples located randomly on the longitudinal joint for QC density testing.	
☐ 	Ensure that one core per subplot is drilled until a full lot is obtained and each core location is recorded.	
☐	Ensure cores are not obtained from excluded areas to determine the lot incentive/disincentive payment.	
☐ 	Identify the samples by longitudinal joint lot and subplot number, location, dates of placement, mixture type, and acceptance samples (Sample Class AS).	

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☐		Task	Reference
☐		Provide the daily theoretical maximum specific gravity value for the mix on each side of the longitudinal joint.	
☐		Package and deliver the samples immediately according to the QC plan. Use sample containers of sufficient strength to prevent samples from being damaged during transport.	

AFTER EVALUATION OF LONGITUDINAL JOINTS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the core holes are backfilled, compacted, and sealed.	

Material & Equipment

The contractor's technician uses an asphalt coring machine to extract density cores from the longitudinal joint at locations determined by the inspection staff.

Mechanical:				
Asphalt Coring Machine				

Construction Methods

The effectiveness of the material placement and compaction operations, as well as the mixture design, on the longitudinal joint density, will be determined on the first day paving abuts a previously placed mat, forming a longitudinal joint.

Five 6-inch-diameter core samples located randomly on the longitudinal joint will be obtained in addition to any incentive/disincentive payment subplot cores for QC density testing. The cores will be tested according to PUB 19 PTM 715 and PTM 716, and the results will be provided to the inspector within 24 hours.

The contractor may elect to make adjustments to the mix design, placement, or compaction operations to ensure adequate in-place density is achieved. If proposing changes that impact the field quality control plan or job mix formula, submit any modifications or revisions to the Department for review.

The Department Representative will select one location in each subplot according to PUB 19 PTM 1 and PTM 729. For vertical joints, center the joint cores on the line where the joint between the two adjacent lifts abuts the surface. For notched wedge joints, center joint cores 6 inches, or $\frac{1}{2}$ the joint taper width, away from the joint line in the direction of the wedge. With the Representative present, drill 6-inch-diameter cores as soon as possible but no later than the day following the construction of the longitudinal joint at each subplot location.

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Do not compress, bend, or distort samples during cutting, handling, transporting, and storing. If samples are damaged, immediately obtain replacement samples, as directed by the Department Representative, from within 12 inches of the original sample location. Within 24 hours after coring, backfill the hole(s) with the mixture of the same JMF or with the mixture used for subsequent courses, and compact and seal the mixture.

Measuring & Payment Methods

A full lot is 12,500 feet of longitudinal joint and will consist of five sublots of 2,500 feet. A single lot need not be contiguous and may include multiple joints throughout the project limits. Partial lots with less than three sublots will be combined with the previous lot. Partial lots with three or more sublots will stand as separate lots.

The proposal will include an item and a predetermined amount of money for the Evaluation of Asphalt Pavement Longitudinal Joint Density and Payment of Incentive/Disincentive. The contract item will have a unit of measure in dollars, a unit price of \$1.00, and a quantity equal to the predetermined amount.

For a full lot with a Percent within Limits (PWL) ≥ 81 , the contractor will receive a prorated positive incentive payment up to a maximum of \$7,500.

For a full lot with a PWL ≤ 49 , the contractor will receive a prorated negative adjustment (disincentive) up to a maximum of \$12,500.

Lots with a PWL ≤ 49 and an average density $\geq 90.0\%$ will be assessed as a disincentive up to a maximum of \$1,000 per subplot, regardless of the PWL.

4. SLURRY SEAL (SEC. 482)

This section addresses the construction of an emulsified asphalt slurry seal course of the type designated.

Type I

Type I is used to seal cracks.

Type II

Type II is used to correct severe surface erosion conditions.

Type III

Type III is used to provide a new, moderate-wearing surface or to build up a crown.

☐ Review  Documentation Required

BEFORE SLURRY SEAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review inspection and quality assurance video on slurry and micro surfacing for general knowledge. Follow PUB 408 requirements.	Slurry Video
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure the air temperature and the pavement temperature are at least 50F.	
☐ 	Verify that the equipment for mixing and placing the slurry seal meets specification requirements.	
☐	Check that the existing surface is properly conditioned.	

DURING SLURRY SEAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the application temperature of the mixture is between 50F and 125F.	

Section 400: Flexible Pavements

☐		Task	Reference
☐		Ensure that joints are constructed according to PUB 408 Section 482.	

AFTER SLURRY SEAL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Allow the slurry seal to completely cure prior to allowing traffic on the surface.	

Material & Equipment

A slurry seal is a homogenous mixture of emulsified asphalt, water, well-graded fine aggregate, and mineral filler that has a creamy, fluid-like appearance when applied. It is thicker than a seal coat (tar and chip).

The mixture must be produced in a self-propelled, continuous-flow mixing apparatus capable of accurately proportioning, combining, and mixing the materials into a homogeneous mixture. The mixer and spreading equipment shall meet the requirements outlined in PUB 408 Section 482.

Mechanical:				
Distributor Truck	Slurry Paver			
Hand Tools:				
Hand Squeegees	Paving Lute	Shovel		

Construction Methods

The contractor will submit a slurry seal mixture that meets all the requirements for the type designated for approval prior to the start of work.

The contractor will condition the existing surface in accordance with PUB 408 Section 482.3. The slurry seal will not be placed unless the temperature is at least 50F.

Specialized equipment will be used to mix and place the slurry seal. The mixer, distributor, and auxiliary equipment shall meet the requirements outlined in PUB 408 Section 482.

Measuring & Payment Methods

Slurry seal is paid in square yards based on actual field measurements and computations.

5. MICRO SURFACING (SEC. 483)

This section addresses the construction of a polymer-modified emulsified asphalt paving system, commonly known as micro surfacing, to fill ruts and/or resurface existing pavements.

Type A

Type A is used to seal cracks and fill voids and shallow ruts (less than ½ inch).

Type B

Type B is used to fill moderate ruts (½ inch to 1 ¼ inches).

Type Rut Fill (RF)

Type Rut Fill (RF) is used to fill deep ruts (2 inches).

☐ Review  Documentation Required

BEFORE MICRO SURFACING CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Review inspection and quality assurance video on slurry and micro surfacing for general knowledge. Follow PUB 408 requirements.	Slurry Video
☐		Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Ensure that the aggregate delivery plan has been submitted and approved by the DME/DMM in PPCC .	
☐		Verify that a certified calibration sheet for the mixing equipment has been submitted in PPCC .	
☐		Obtain acceptance samples of the aggregates from stockpiles in accordance with PUB 19 PTM 607 and immediately deliver them for testing in accordance with PTM 616 and PTM 100.	
☐		Attend the pre-placement meeting to review specifications, the QC plan, and the aggregate delivery plan.	
☐		Ensure the air temperature is at least 50F and review specific date restrictions for various Districts/regions.	
☐		Check that the existing surface is properly conditioned.	

DURING MICRO SURFACING CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Identify a location to perform the test strip. Witness, evaluate, and approve the test strip.	
☐		Verify proper application of tack coat was applied.	
☐		Calculate yield at the end of the day's application.	

AFTER MICRO SURFACING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the mixture properly sets within one hour of placement. If it takes longer than an hour and twenty minutes to properly set, stop operations immediately.	

Material & Equipment

Micro surfacing is an advanced form of slurry seal that uses the same basic ingredients (emulsified asphalt, water, fine aggregate, and mineral filler) and combines them with advanced polymer additives.

The mixing and spreading equipment must be produced and placed with specialized equipment meeting the requirements outlined in PUB 408 Section 483.

Mechanical:				
Pneumatic Tire Roller	Slurry Paver			
Hand Tools:				
Hand Squeegees	Paving Lute			

Construction Methods

The contractor will submit a JMF and QC plan that will include the number of applications and the mix design used with each application. A certified calibration sheet shall be provided for the mixing

Section 400: Flexible Pavements

equipment for each mix design to be used within 60 days before its use on the project. An aggregate delivery plan will also be submitted for approval before the start of work.

At least two weeks before the start of work, samples of the aggregates from stockpiles will be obtained for testing in accordance with PUB 408 Section 483.3.

A pre-placement meeting will be held with both the contractor and Department personnel present prior to placing any material on the project.

The contractor will clean the surface and ensure all pavement markings and legends are completely removed before placing any mixture. The tack coat will be applied before placing the mixture on existing concrete surfaces.

The Department Representative will identify a location to perform the test strip. The work will not continue until the Representative has approved the test strip. The test strip is mandatory and cannot be waived or eliminated.

Measuring & Payment Methods

Micro surfacing is paid in two ways. Either in square yard when it is based on area or ton when it's based on weight.

6. ULTRA-THIN BONDED WEARING COURSE (SEC. 489)

This section addresses the requirements for placement and inspection of the Ultra-Thin Bonded Wearing Course (UTBWC). All sections for Standard Asphalt Paving Operations should be referenced in coordination with the information listed below specific to UTBWC.

☐ Review  Documentation Required

BEFORE UTBWC PLACEMENT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Check that the paver has a built-in spray bar to apply Ultra-Thin Friction Course Emulsified Membrane (UTFCEM).	
☐ 	Verify all pavement markings are eradicated and the surface is clean and dry prior to UTBWC placement.	

DURING UTBWC PLACEMENT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that the existing surface is clean and dry and that air and surface temperature are 50F or above.	
☐ 	Monitor placement of UTFCEM to verify the required application rate.	
☐ 	Monitor placement of UTFCEM to verify the UTBWC is placed within 5 seconds of the membrane material.	
☐ 	Verify material thickness by performing yield calculations and manual depth checks are not required. Refer to PUB 8 Example Calculations .	
☐ 	Ensure rollers are operating in static mode only. Vibratory mode is only permitted at joints where required.	
☐ 	Ensure only vertical butt joints are used during placement. Verify the vertical joint face has not been painted with a binder prior to adjacent lane placement.	

AFTER UTBWC PLACEMENT CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the texture of the mat behind the paver is uniform.	

Material & Equipment

Pavers should be self-contained and power-propelled, with activated screeds and automatic screed controls capable of producing a finished surface of specified evenness and texture. The paver must meet all the requirements of PUB 408 Section 413.3. Use pavers that include a built-in spray bar placed in front of the variable-width heated screed unit so that the operations of spreading UTFCEM and the UTBWC are performed in succession within a period of less than five seconds.

The paver must be set at the required depth and cross slope at the beginning of the paving operation. Prior to compaction, the inspector should check the mat behind the paver for uniformity. If the mat is not uniform, the inspector should check the screed and make sure the screed is hot. The slow, continuous movement of the paver provides for a uniform riding surface. However, any adjustments to the paver are made by the contractor.

Mechanical:				
Asphalt Paver with Vibrating Screed				

Construction Methods

Refer to PUB 408 Sections 413.3 and 489.3.

Measuring & Payment Methods

Payment for tonnage items is based on the amount of material incorporated into the work, using the weight noted on the delivery tickets received from the asphalt trucks. Square yard items are field measured; computations must be shown on a PSA or spreadsheet. Yield tests are performed to check the amount of material placed. Waste needs to be determined and agreed to with the contractor and deducted from the payment.

Square yard items can be paid progressively, based on construction station lengths. The final payment, adjusted for progress payments, is based on field measurements and computations. The pavement width measurement should not exceed the plan width unless authorized by a Department Representative.

REFERENCES

Approved Quality Control Plan – [PPCC](#)

Approved Asphalt Mix Designs Source of Supply – [ECMS](#)

Aggregate Delivery Plan – [PPCC](#)

[National Cooperative Highway Research Program](#) Report 228

[PUB 2](#) Project Office Manual

- Part B, Section 8 Electronic Construction and Materials Management System
- Part C, Section 4 Flexible Pavements (400)
- Appendix A, Material Forms (Sample Identification Form TR-447)
- Appendix A, Material Forms (Optimum-Rolling Pattern for Asphalt Density Acceptance by Nuclear Method Form TR-4276B)

[PUB 19](#) Field and Laboratory Testing Manual

- PTM 1 (Probability Sampling)
- PTM 100 (Amount of Material Finer than 75 μm (No. 200) Sieve in Aggregate)
- PTM 402 (Determining In-Place Density and Moisture Content of Construction Materials by Use of Nuclear Gauges)
- PTM 403 (Determining In-Place Density of Asphalt Concrete Using Electrical Impedance Measurement Methods)
- PTM 428 (Measuring Pavement Profile Using a Light Weight Profiler)
- PTM 607 (Sampling Stone, Slag, Gravel, Sand, and Stone Block for Use As Highway Materials)
- PTM 616 (Sieve Analysis of Coarse and Fine Aggregate)
- PTM 715 (Determination of Bulk Specific Gravity of Compacted Asphalt Mixtures)
- PTM 716 (Determination of Bulk Specific Gravity of Compacted Asphalt Mixtures that Absorb More Than 3 Percent Water by Volume)
- PTM 729 (Sampling Roadway Asphalt Concrete)
- PTM 737 (Measuring the Thickness of Asphalt Concrete Courses)
- PTM 746 (Sampling Asphalt Paving Mixtures)
- PTM 747 (Determination of Distributor Application Rate in the Field)

[PUB 41](#) Producers of Asphalt Materials (Bulletin 41)

[PUB 72M](#) Roadway Construction Standards

- RC Standard 28M (Overlays Transitions and Paving Notches)

[PUB 213](#) Temporary Traffic Control Guidelines

[PUB 408](#) Highway Construction Specifications

- Section 108 (Performance and Progress)
- Section 404 (Evaluation of Asphalt Pavement Ride Quality and Payment of Incentive)
- Section 405 (Evaluation of Asphalt Pavement Longitudinal Joint Density and Payment of Incentive/Disincentive)
- Section 410 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed HMA Fine-Graded Courses)
- Section 412 (Superpave Mixture Design, Construction of Plant-Mixed 6.3 MM Thin Asphalt Overlay Courses)

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- Section 413 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed Asphalt Courses with Percent within Limits and LTS Testing (PWL-LTS))
- Section 419 (Stone Matrix Asphalt Mixture Design, RPS Construction of Plant-Mixed Wearing Courses)
- Section 450 (Manual Asphalt Patching)
- Section 460 (Asphalt Tack Coat)
- Section 482 (Slurry Seal)
- Section 483 (Polymer-Modified Emulsified Asphalt Paving System (Micro Surfacing))
- Section 489 (Ultra-Thin Bonded Wearing Course)
- Section 490 (Removal of Existing Surface Course)
- Section 491 (Milling of Asphalt Pavement Surface)
- Section 492 (Profile Milling of Asphalt Pavement Surfaces)
- Section 515 (Sawing and Sealing of Asphalt Overlays)
- Section 703 (Aggregate)

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SECTION 500: RIGID PAVEMENT

GOALS

- Ensure the BEST possible riding surface is obtained for the motoring public.
- Ensure that EVERY area of the pavement is free from defects.
- Ensure that EVERY area of the pavement has been properly compacted.

RIGID PAVEMENT SAFETY

- **Traffic Control:** Properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** An asphalt paving operation has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Nuclear Gauge:** Ensure the operator is wearing a badge and safely storing the source rod prior to moving.
- **Concrete Materials:** Learn and follow proper emergency procedures, as materials can be caustic and can cause injury to your skin, eyes, and lungs.
- **Weather Conditions:** Know the weather conditions each day and prepare for current and changing weather conditions.
- **Personal Protective Equipment (PPE):** Wear proper PPE when working near construction operations.

1. REINFORCED OR PLAIN CEMENT CONCRETE PAVEMENTS & PROTECTIVE COATINGS (SEC. 501, 503, & 506)

This section addresses reinforced or plain cement concrete pavements, reinforced or plain cement concrete pavement restrictive performance standards (RPS), and protective coatings for cement concrete pavement.

Plain Cement Concrete Pavements

Plain cement concrete pavements use dowels to provide load transfer and prevent faulting and contain no reinforcing since joint spacings are reduced to locations of natural cracking.

Reinforced Cement Concrete Pavements

Reinforced cement concrete pavements use dowels to provide load transfer and prevent faulting and contain reinforcing to control cracking.

Reinforced or Plain Cement Concrete Pavement RPS

Restricted performance pavements are similar to plain and reinforced cement concrete pavements but contain specifications that are meant to improve the ride quality and long-term durability and performance of the concrete pavement.

Protective Coatings for Cement Concrete Pavement

For concrete pavements placed after September 1st, a protective coating is required to prevent scaling from deicing chemicals during winter maintenance operations.

☐ Review  Documentation Required

BEFORE REINFORCED OR PLAIN CEMENT CONCRETE PAVEMENTS & PROTECTIVE COATINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and field operation quality control (QC) plan are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Verify grade lines or forms have been set to grade and checked prior to concrete placement.	
☐ 	Confirm the subbase is clean, graded to proper grade, and approved prior to concrete placement.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Ensure construction traffic does not travel on the subbase after the grade has been approved.	
☐		Calibrate testing equipment as required prior to concrete placement.	eConcrete
☐		Ensure the contractor sprinkles water on the subbase before paving to ensure a moist base course and to cool the surface temperature below 115F; ensure operations are discontinued if the surface temperature of the base cannot be kept below 115F.	

DURING REINFORCED OR PLAIN CEMENT CONCRETE PAVEMENTS & PROTECTIVE COATINGS CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	eConcrete
☐		Ensure concrete is not placed when the evaporation rate exceeds 0.2 pounds per square foot per hour unless mitigation measures are employed.	MCDocs
☐		Ensure paving is discontinued when the air temperature falls below 40F. Concrete temperature must be between 50F and 90F.	
☐		If the air temperature rises above 85F, ensure concrete temperatures are taken every 30 minutes and at the conclusion of the mixing cycle. Ensure operations are discontinued if the concrete temperature rises above 90F.	
☐		Verify aggregate or mixing water is cooled or ice is added to lower the concrete temperature to the desired range of 50F to 90F.	
☐		Confirm the use of steel forms not less than 10 feet in length with form depth and base width equal to pavement depth.	
☐		Ensure that the forms are clean and oiled before each use, set to proper grade, accurately aligned, and secured with steel pins.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		When slip-form paving, test for edge slumping with a 12-foot straight edge, verifying edge slump does not exceed 1/8-inch between adjacent lanes and ramps and 1/4-inch between lanes and shoulders and ramps and shoulders.	
☐		Verify that pre-molded expansion joint filler not less than 1/2 inch is placed adjacent to all utility holes, inlets, and similar appurtenances, as well as where pavement adjoins rigid structures, bridges, or culverts.	
☐		Confirm reinforcing steel is free of defects.	
☐		Ensure acceptable supports for reinforcing steel and mesh areas specified in PUB 408 Section 1002.3 are used.	
☐		Verify rebar, dowel bars, or load transfer units are properly set and in place per specifications and plans.	
☐		Confirm dowel bars are used as specified in PUB 72M RC Standard 20M.	
☐		Ensure transverse joints are placed perpendicular to the centerline, forming a continuous joint across the entire pavement.	
☐		Immediately after placement, ensure the concrete is struck off and screeded with a finishing machine, as necessary, to consolidate the concrete and to leave a uniformly textured surface.	
☐		Verify longitudinal joints are constructed according to PUB 72M RC Standard 20M and PUB 408 Section 501. Ensure the longitudinal joints do not traverse a driving lane or conflict with the final pavement markings.	
☐		If more than a 30-minute interruption occurs, ensure a transverse joint, using a bulkhead, is constructed.	
☐		Verify locations for transverse saw cuts for contraction joints are marked directly over the corresponding dowel bar basket.	
☐		Confirm pavement surfaces are protected from rain.	
☐		Ensure contraction joints are placed in the second lane of paving to reflect joints and cracks from the first lane.	
☐		Verify transverse expansion joints are placed where indicated.	
☐		Confirm tie bars are placed as indicated, ensuring 15 tie bars from the day's paving are selected and tested for pullout resistance.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure water is not added to the concrete to assist in finishing.	
☐		Verify manual strike-off methods are not used unless directed.	
☐		After the concrete has been struck off and consolidated, confirm a float is used to smooth and fill open-textured pavement, as necessary.	
☐		While concrete is still plastic, test the surface of the concrete using a 12-foot straight edge to ensure that the surface meets requirements.	
☐		Ensure a textured finish with grooves is created as per PUB 408 Section 501 specifications.	
☐		Verify curing is placed after final texturing and within 30 minutes of the dissipation of bleed water in accordance with PUB 408 Section 501.3.	
☐		Ensure the curing materials are in place until the pavement has achieved sufficient strength for opening to traffic as specified in PUB 408 Section 501.3.	
☐		If the air temperature is expected to fall below 50F, ensure a high-low thermometer is placed on the concrete surface and monitored, verifying the concrete temperature of at least 40F is maintained for at least four days and until the concrete reaches 3,000 psi. If the temperature falls between 40F and 35F, the cure period is extended by an additional day. If the temperature falls below 35F, the concrete is considered defective and is removed and replaced.	
☐		Ensure concrete QC test cylinders are cured in the same manner as the in-place concrete.	
☐		Verify all concrete joints are sealed before the surface is open to traffic.	

AFTER REINFORCED OR PLAIN CEMENT CONCRETE PAVEMENTS & PROTECTIVE COATINGS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 500: Rigid Pavement

☐		Task	Reference
☐		After the concrete has hardened, ensure the surface is tested using a 12-foot straight edge, as specified. High points (more than ¼-inch) are removed by grinding.	
☐		Ensure steel forms are removed after the minimum required time, usually after the concrete has set as directed, verifying honeycombed areas are patched.	
☐		Ensure vehicles and people are not allowed on the concrete surface for at least 96 hours or until 3,000 psi is achieved.	
☐		Verify one core is drilled for every 3,000 square yards of pavement in each lane to test for depth. If depth is deficient by more than ¼ inch, additional cores are drilled at 100-foot intervals in both directions to determine the extent of the discrepancy.	
☐		Ensure every tenth core is submitted for compressive strength testing. If core strength is less than 3,500 psi, ensure an investigation and written evaluation is provided.	
☐		Verify any work that is considered defective is removed and replaced at a minimum of 10 feet between transverse joints unless otherwise directed to decrease payment for concrete left in place.	
☐		In RPS, ensure each lot is 5,600 square yards. Each lot is divided into four equal sublots of 1,400 square yards. Partial lots (e.g., end of paving or lane) are combined with the previous lot or made into a new smaller lot based on the procedures in the PUB 408 Section 506.	
☐		Ensure one core is drilled for each subplot of pavement in each lane to test for depth. The lot will be considered defective if the average core depth of the lot is less than the design thickness (D) minus ½ inch or more than one individual subplot core depth is less than the design thickness minus ½ inch.	
☐		For RPS concrete pavement, test each subplot for plastic air content and compressive strength per PUB 408 Section 506. Two test cylinders are molded from each test location, as determined by PUB 19 PTM 1.	
☐		Verify payment amounts are adjusted based on deficiencies found from the testing, following procedures noted in PUB 408 Section 506.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Section 500: Rigid Pavement

☐		Task	Reference
Protective Coating			
☐		Confirm concrete surfaces are dry and free of all foreign matter before a protective coating is applied.	
☐		Ensure protective coating is applied as specified in PUB 408 Section 503 on all concrete pavements and shoulders constructed after September 1.	
☐		Ensure a minimum of 28 days have elapsed before a protective coating is applied to surfaces cured with white membrane curing compound; otherwise, verify seven days have elapsed after removing curing covers and before applying protective coating on all other types of curing.	
☐		Verify protective coating is applied according to the manufacturer's recommendations. Unless directed, the protective coating is applied in weather suitable for drying when the air temperature and concrete surface temperature are between 35 and 100F. A 24-hour dry time is allowed between coats.	
☐		When the first application of the protective coating is applied to surfaces carrying traffic, ensure the surface is closed to traffic for at least four hours and until tackiness has disappeared.	
☐		After the second application of the protective coating has been applied, ensure the surface is closed to traffic for at least six hours or until tackiness has disappeared and no pickup results from use.	
☐		Verify protective coating application rates are according to the manufacturer's recommendations and/or PUB 408 Section 503 specifications.	

Material & Equipment

All materials used in the construction of the cement concrete pavement must be provided from an approved source of supply. The materials used for the cement concrete pavement and RPS pavement must include an approved concrete mix design, delivered from an approved supplier utilizing concrete mixer trucks, or flatbed trucks for slip-form paving, or can be produced on-site if approved. A liquid membrane-forming curing compound is used for curing, supplied by an approved source listed in PUB 35 Bulletin 15. The material used for the protective coating is a penetrating sealer supplied by an approved vendor listed in PUB 35 Bulletin 15.

The contractor may use a slip form machine or finishing equipment capable of providing acceptable pavement and clean steel forms, as well as a concrete sprayer to apply the curing compound and the protective coating. Load transfer units are used for joints, as are concrete saws for saw cutting the joints. The contractor must also provide concrete testing equipment, thermometers, air meters conforming to AASHTO T196 and T152, and slump cones conforming to AASHTO T119 to test the concrete.

Section 500: Rigid Pavement

Mechanical:				
Concrete Finisher	Concrete Mixer Truck	Concrete Saw	Flatbed Truck	Slip Form Machine
Tri-Axle Dump Truck				
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Screed	Shovel	Trowel	
Testing/Inspection:				
12-foot Straight Edge	Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level

Construction Methods

At least two weeks prior to the start of paving, a comprehensive paving operation QC plan must be submitted for review and acceptance by a Department Representative. Before concrete placement, the subgrade and subbase are graded and properly compacted. If a slip form machine is to be used, grade lines are established. If steel forms are required, they should be in place and inspected. On some projects, a permeable base is placed on the subbase before concrete paving.

Load transfer units, pre-molded expansion material, rebar, and dowel bars are installed or available for installation during the placement operation. Concrete is delivered to the site from the concrete supplier or produced at an on-site plant. Before placement, concrete must be tested for air, slump, and temperature to ensure compliance. Concrete is placed using either a slip-form machine or paver (if steel-form placement is used). After the concrete is placed, it is vibrated, finished by floating and straight-edged to correct any irregularities, and then textured properly as required by the specifications.

The contractor's certified technician performs QC testing as required by PUB 408 Section 704.1 and the QC plan. Department Representatives witness all testing. A Department Representative will perform field verification testing on the initial acceptance sample and every tenth sample after, as required by the specifications. Quality Assurance (QA) personnel will obtain samples and perform their required QA testing.

Curing is applied after finishing and texturing the concrete according to the specifications in PUB 408 Section 501.3. All joint sawing, if applicable, must also be performed as soon as the concrete has sufficiently hardened, according to specifications in PUB 408 Section 501.3. If steel forms are used, like in the case of patching, they must be removed before sawing the joints and then put back in place once the sawing is complete to continue the curing process.

Measuring & Payment Methods

Plain or reinforced concrete pavements, RPS pavements, and protective coatings are paid for by the square yard according to PUB 408 Section 501.4.

Payments for RPS pavements are made on a lot-by-lot basis at the contract price, adjusted for pavement characteristics relative to depth, compressive strength, and air content. Payment is calculated using the multiple characteristics formula in PUB 408 Section 506.4.

2. PAVEMENT RELIEF JOINT (SEC. 504)

This section addresses the construction of a pavement relief joint, including subbase material and necessary excavation.

Pavement Relief Joint

A pavement relief joint is used to reduce compressive stresses in concrete pavements and thereby reduce pressure-related damage.

Subbase Material

Subbase material is either an aggregate, cement-treated, or asphalt-treated base course.

☐ Review  Documentation Required

BEFORE PAVEMENT RELIEF JOINT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs

DURING PAVEMENT RELIEF JOINT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure excavation for the concrete sleeper slab occurs after the subbase is constructed.	MCDocs
☐	Verify the sleeper slab for reinforced or plain cement concrete pavements is constructed per PUB 72M RC Standards 23M and 24M and PUB 408 Section 504 specifications.	
☐ 	Confirm the asphalt base course is constructed as per PUB 408 Section 313.	
☐	Ensure the Superpave wearing course is constructed per PUB 408 Section 413 specifications.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Verify concrete dimensions, rebar clearances, sizes, and spacing are as required by PUB 72M RC Standard 24M.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan and that test results are within specified limits.	eConcrete MCDocs
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Document required information for asphalt material received and the results of testing.	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	

AFTER PAVEMENT RELIEF JOINT CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Materials for the work include concrete, rebar, subbase, and asphalt material. If required, the contractor may use metal and wood forms.

Asphalt and concrete testing equipment may be required. Equipment, including concrete vibrators, trowels, and curing materials, may be used for placing the concrete sleeper slab. Compaction equipment and hand tools may be used for the placement of asphalt and subbase material.

Mechanical:				
Asphalt Paver	Concrete Mixer Truck	Concrete Saw	Excavator	Skid Steer
Tri-Axle Dump Truck	Vibratory Plate Compactor	Vibratory Steel Wheel Roller		
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer

Section 500: Rigid Pavement

Concrete Vibrator	Hammer	Hand Tamper	Rake	Screed
Shovel	Trowel			
Testing/Inspection:				
12-foot Straight Edge	Concrete Testing Equipment	Depth Check Gauge	Infrared Thermometer	Measuring Wheel
Nuclear Gauge	Probe Thermometer	Smart Level		

Construction Methods

After the subbase has been properly prepared, graded, and compacted, a sleeper slab is placed according to the standard drawings, PUB 408 Section 504, PUB 72M RC Standard 23M, and contract documents.

The roadway and approach slabs are then constructed, followed by the placement of an asphalt base course and a wearing course in the pavement relief joint.

Measuring & Payment Methods

Payment for a relief joint is made by the linear foot.

3. BRIDGE APPROACH SLABS (SEC. 505)

This section addresses reinforced cement concrete approach slabs, including the joint adjacent to bridge superstructures.

Reinforced Cement Concrete Approach Slabs

The approach slab provides a transition between the roadway pavement and the bridge. The approach slab acts as an intermediate bridge to span the portion of the embankment directly behind the abutment/back wall, which was excavated to construct the abutment/back wall.

☐ Review  Documentation Required

BEFORE BRIDGE APPROACH SLABS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure the subbase is compacted and graded as specified.	
☐	Verify the contractor has bulkhead materials prepared and on-site in case operations are stopped unexpectedly for extended periods.	
☐ 	Provide sketches and quantity calculations in the project site activity (PSA).	
☐ 	Ensure sleeper slab is placed per PUB 72M RC Standard 23M.	
☐ 	Verify subsurface drain is installed on the low side of the sleeper slab.	

DURING BRIDGE APPROACH SLABS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Ensure slabs are constructed as shown on PUB 72M RC Standard 23M and as specified in PUB 408 Sections 405 and 501; a longitudinal joint is not required.	
☐		Check formwork and rebar as they are placed, and verify coating, spacing, size, number, and clearances as required by PUB 408 Sections 501 and 505. Verify dowels for the Type E joints, if applicable, are installed between the approach slab and the roadway pavement.	
☐		Verify the air temperature conforms to specifications for concrete placement in accordance with PUB 408 Sections 501 and 505.	
☐		Check top rebar clearances, concrete depths, and out-to-out (slab width) measurements prior to concrete placement. This may be done using a string line or a dry run of the finishing machine.	
☐		Ensure the approach slab concrete is cured as specified in PUB 408 Section 501.	
☐		Verify that a neoprene compression is installed as specified in PUB 72M RC Standard 23M between the approach slab and the bridge structure.	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		Document all concrete testing performed and all concrete placed.	eConcrete
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure joints are saw cut and sealed as required in PUB 408 Section 501.	

AFTER BRIDGE APPROACH SLABS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Class AA (Structure Class 3 (S3)) concrete is usually used for approach slabs and sleeper slabs. The concrete must be supplied by an approved concrete batch plant and mixed using an approved mix design for the class indicated.

Burlap, liquid membrane curing compound, weeper hoses, polyurethane, and heaters are among the materials used for approach slab curing.

Formwork may be constructed of wood or steel. Epoxy-coated rebar is also used for approach slab construction.

Equipment, including pumps, buckets, and conveyors, are required to place concrete. Concrete vibrators are important for acceptable concrete consolidation. Equipment for testing the concrete or other materials is used as required.

For finishing concrete, the contractor uses deck finishing machines, trowels, and a metal tine brush. Equipment such as excavators and vibratory steel wheel rollers are used to place and compact subbase material beneath the approach slab.

Mechanical:				
Concrete Mixer Truck	Concrete Saw	Deck Finisher	Excavator	Material Transfer Vehicle
Vibratory Steel Wheel Roller				
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Hammer	Metal Tine Brush	Screed	Shovel
Trowel				
Testing/Inspection:				
Concrete Testing Equipment	Measuring Wheel	Nuclear Gauge	Probe Thermometer	Smart Level

Construction Methods

The bridge should be backfilled according to the standard drawings, with selected borrow excavation, as shown on PUB 72M RC Standard 11M and as specified in PUB 408 Section 1001.3. It is compacted with equipment for the material classification and placement condition as specified in PUB 408 Section 206.3 and as shown on the standard drawings and contract requirements. After the subbase is placed to grade and properly compacted, the bridge approach slab is formed. If required, rebar and dowels are installed.

Section 500: Rigid Pavement

The concrete is then placed. A neoprene seal is installed between the bridge and the slab. After placement, the concrete is cured, and longitudinal joint saw cuts are made (if required).

Measuring & Payment Methods

Payment for a slab is made by the square yard.

4. EVALUATION OF CONCRETE PAVEMENT RIDE QUALITY & PAYMENT OF INCENTIVE (SEC. 507)

This section addresses evaluating concrete pavement surface profile and determining the associated ride quality incentive.

☐ Review  Documentation Required

BEFORE EVALUATION OF CONCRETE PAVEMENT RIDE QUALITY & PAYMENT OF INCENTIVE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Ensure all pavement profiling equipment is verified by the Department and in accordance with PUB 19 PTM 428.	
☐ 	Verify Lightweight Profiler operator is certified in accordance with PUB 19 PTM 428.	Certification List
☐	Measure the lot, which is determined as 528 feet of a single pavement lane with the same lot type, per PUB 408 Section 507.1 specifications.	
☐	Verify the contractor provides the necessary station marking.	
☐ 	Confirm the pavement is swept prior to testing.	
☐ 	Record test locations and results of the ride quality before any diamond grinding in accordance with PUB 408 Section 507.3.	

DURING EVALUATION OF CONCRETE PAVEMENT RIDE QUALITY & PAYMENT OF INCENTIVE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the profile is measured in all areas of pavement, excluding bridge decks, ramps less than 1,500 feet in length, tapered pavements less than 12 feet wide, partial lots shorter than 100 feet, shoulders, median, and other pavement indicated.	
☐	Verify approach slabs and pavement relief joints are included in the testable area.	
☐ 	Ensure the surface profile is determined for each lot, and profile data is immediately submitted to the Department Representative.	
☐ 	Test the excluded areas with a 12-foot straight edge. At each stage, the straight edge is held in contact with the surface and parallel to the road centerline. In successive positions, the pavement surface is tested from one side to the other. Each stage involves advancing 5 feet until the entire area has been tested. Grinding may be required to bring excluded areas into compliance.	
☐	Compare the lot international roughness index (IRI) to Table A in PUB 408 Section 507.4 to determine if correction is required.	
☐	In the excluded areas, high points and depressions of more than ¼ inch are considered defective. Ensure carbide or diamond grinding equipment is used to correct defective areas per specifications in PUB 408 Section 507.3.	

AFTER EVALUATION OF CONCRETE PAVEMENT RIDE QUALITY & PAYMENT OF INCENTIVE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the profile machine calibration and profile documentation are obtained at the end of the day.	
☐	Verify payment is determined per Table A in PUB 408 Section 507.4.	

Material & Equipment

There is no material for this operation.

The equipment for the work includes Department-approved pavement surface profile measuring equipment and a grinder for corrective action if required. A certified operator must operate the equipment.

Mechanical:				
Pavement Profile Grinder				
Testing/Inspection:				
12-foot Straight Edge	High Speed Profiler			

Construction Methods

Prior to the start of profile collection, verify traffic control is established, per the traffic control plan, and the pavement is cleaned of any debris.

Lots are determined according to PUB 408 Section 507.1 specifications. Pavement ride quality is tested in specified areas using approved pavement profiling equipment. The testing equipment is calibrated daily, and the results of the tests are provided to a Department Representative.

Areas not tested with the profiling equipment are tested with a 12-foot straight edge. Those areas considered defective are corrected or replaced.

Measuring & Payment Methods

The proposal will include an item and a predetermined payment amount for the evaluation of concrete pavement ride quality and payment of incentive. The contract item will have a unit of measure in dollars, a unit price of \$1.00, and a quantity equal to a predetermined amount (PDA).

An incentive payment for the ride quality is determined by a Department Representative per lot, based on the IRI and Table A in PUB 408 Section 507.

5. LONGITUDINAL & TRANSVERSE GROOVING OF CONCRETE PAVEMENTS (SEC. 509, 510, 514, & 517)

This section addresses next generation concrete surfaces, longitudinal and transverse grooving, and diamond grinding of concrete pavement.

Next Generation Concrete Surface (NGCS)

Next Generation Concrete Surface (NGCS) utilizes diamond grinding and grooving on new or existing cement concrete pavement, which is addressed in PUB 408 Section 509. The NGCS is achieved through the diamond grinding of existing concrete surfaces and then the cutting of longitudinal grooves and transverse grooves in the existing concrete pavement to replace the original texture. This grinding and grooving can be attained in either a single-pass or two-pass operation based on the type of equipment selected by the contractor in accordance with PUB 408 Section 509.

Longitudinal Grooving of Existing Concrete Pavement

This work is the cutting of longitudinal grooves in existing concrete pavement in accordance with PUB 408 Section 510.

Transverse Grooving of Concrete Pavement for Retexturing

This work is the cutting of transverse grooves in the existing concrete pavement in accordance with PUB 408 Section 517.

Diamond Grinding Concrete Pavement

This work is the diamond grinding of existing concrete surfaces in accordance with PUB 408 Section 514.

☐ Review  Documentation Required

BEFORE LONGITUDINAL & TRANSVERSE GROOVING OF CONCRETE PAVEMENTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure pavement repairs, including concrete pavement patching, concrete spall repair, dowel retrofit, slab stabilization, and slab jacking, are completed before the start of any diamond grinding operations.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Test the pavement surface roughness in the longitudinal direction and submit the record of the information to the Department Representative before beginning any diamond grinding work. Following grinding of the pavement surface, test the longitudinal roughness as specified in PUB 408 Section 507.3 and regrind pavement segments as specified in PUB 408 Section 507.3.	

DURING LONGITUDINAL & TRANSVERSE GROOVING OF CONCRETE PAVEMENTS CHECKLIST

☐		Task	Reference
Next-Generation Concrete Surface			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor prevents slurry from flowing across lanes occupied by traffic.	
☐		Ensure the NGCS is attained in either a single-pass or two-pass operation as determined by the capability of the contractor's equipment.	
☐		Verify the entire pavement surface is textured in the longitudinal direction parallel to the pavement center line.	
☐		Confirm the grinding is performed in a manner that eliminates faults at joints and cracks so there is a maximum 1/16-inch differential between adjacent sides of joints and cracks.	
☐		Ensure a feather pass is cut for proper pavement drainage on the adjacent shoulders and ramps to maintain a consistent cross slope.	
☐		Verify the existing cross slope of the roadway is maintained. No depressions or misalignment of slope greater than 1/8 inch in 12 feet, when measured with a 4-foot straight edge placed perpendicular to the center line, will be allowed. Non-compliant areas will be reground. Straight edge requirements will not apply across longitudinal joints.	
☐		Confirm the contractor provides proper drainage of the roadway by making a feather pass a minimum of 2 feet into the adjacent shoulder, gore area, auxiliary lane, or ramp lane, using conventional diamond grinding. The minimum length of a feather pass will be 100 feet.	

Section 500: Rigid Pavement

□		Task	Reference
□		Ensure the contractor constructs one 300-foot test section in a single lane to demonstrate the equipment and procedures will provide an acceptable surface. Do not proceed until the test section has been approved. The test section may be waived if approved in writing by the District Executive (DE).	
□		Verify that the NGCS produces a pavement surface true to grade with a longitudinally grooved texture and that the ground surface is smooth and contains no ridges that exceed 1/8-inch. A minimum of 98% of the pavement surface shall be textured utilizing NGCS. Depressed pavement areas due to subsidence, edge slump, or other localized causes will be excluded from this requirement if approved.	
□		Determine the ride quality of the pavement as specified in Section 507.3 after the completion of the NGCS. Verify the contractor provides a maximum IRI of 70 inches/mile for facilities if posted speed limits are greater than 45 miles per hour and a maximum IRI of 90 inches/mile for facilities if posted speed limits are less than or equal to 45 miles per hour. To receive payment, all IRI lots must meet the requirements for the posted speed limits.	
□		Designate lots starting at the beginning ride quality limit and continuing to the ending ride quality limit for each pavement lane and ramp that is 12 feet or wider. Do not include the length of excluded areas in the 528 feet. Excluded areas will consist of bridge decks, ramps less than 1,500 feet long, tapered pavements less than 12 feet wide, partial lots less than 100 feet long, shoulders, medians, and other pavement surfaces as indicated.	
□		Ensure the contractor cleans the entire roadway after the operation, prior to opening to traffic.	
Single Pass Operation			
□		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Ensure the contractor prevents slurry from flowing across lanes occupied by traffic.	
□		Ensure the contractor cleans the entire roadway after the operation, prior to opening to traffic.	
□		Ensure the contractor provides a flush ground surface that contains longitudinal grooves constructed in one single pass, stacking the diamond blade with two types of diamond grinding blades arranged	

Section 500: Rigid Pavement

☐		Task	Reference
		to provide a ground surface along with blades that produce longitudinal grooves.	
☐		Verify the diamond blade stack for texturing is mounted on a minimum 4-foot-wide grinding head, stacked with 1/8-inch blades separated by 1/32-inch spacers.	
☐		Confirm all blades on the grinding head are straight across the contact surface with no bowing if installed to grinding equipment using a 4-foot straight edge.	
☐		Ensure the blades used to create the longitudinal grooves are ¼ to 3/8 inches taller in diameter than the grinding blades. The longitudinal grooves should be spaced among the grinding blades approximately ½-inch center to center and shall produce grooves 1/8-inch to 3/16-inch in depth.	
☐		Verify the grinding equipment is equipped with a guide to ensure NGCS is parallel to the roadway centerline. No unground surface area is allowed between passes. Do not overlap any pass of the grinding/grooving head by more than 1 inch.	
☐		Ensure the contractor cleans the entire roadway after the operation, prior to opening to traffic.	
Two Pass Operation			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor prevents slurry from flowing across lanes occupied by traffic.	
☐		Ensure the contractor provides a flush ground surface that contains longitudinal grooves constructed in two operations.	
☐		Verify the first operation will grind the pavement surface using a diamond blade stack mounted on a minimum 4-foot-wide grinding head, stacked with 1/8-inch blades separated by 1/32-inch spacers. If mounted on the grinding head, verify all blades used to produce the ground surface will be flat across the contact surface and in the same plane as other flush grinding blades.	
☐		Confirm all blades on the grinding head are straight across the contact surface with no bowing if installed to grinding equipment using a 4-foot straight edge.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Ensure the second operation will provide the longitudinal grooves. Verify the longitudinal grooves are 1/8-inch wide and 1/8 to 3/16 inches deep and spaced approximately 1/2-inch center to center.	
☐		Verify the contractor does not overlap any pass of the grinding/grooving head by more than 1 inch.	
☐		Ensure the contractor cleans the entire roadway after the operation, prior to opening to traffic.	
Longitudinal & Transverse Grooving			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Confirm the contractor grooves the existing pavement surface between limiting stations.	
☐		Ensure the contractor prevents slurry from flowing across lanes occupied by traffic.	
☐		Verify that the longitudinally existing pavement surface between limiting stations is grooved per PUB 408 Section 510 specifications and that bridge decks are not grooved.	
☐		Confirm that flailing-type equipment is not used as it is prohibited.	
☐		Ensure the contractor cuts grooves 3/32 inch wide, with a tolerance of plus or minus 1/16 inch, with a 3/4 inch center-to-center spacing and a depth of 3/16 inch per PUB 408 Sections 510 and 517.	
☐		Verify that the contractor does not cut grooves within 6 inches of the longitudinal joint of the edge of the pavement, as this area usually contains traffic control stripping and should not be disturbed.	
☐		Confirm existing longitudinal paint lines are not disturbed.	
☐		Ensure the contractor cleans the entire roadway after the operation, prior to opening to traffic.	
Diamond Grinding			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor prevents slurry from flowing across lanes occupied by traffic.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Confirm the contractor begins and ends grinding at lines normal to the pavement centerline.	
☐		Ensure the pavement is ground longitudinally and in either direction as specified in PUB 408 Section 510, unless otherwise specified, to grind with traffic flow for safety.	
☐		Verify a uniformly finished surface is created to eliminate joint or crack faults and to provide positive lateral drainage.	
☐		Confirm the contractor textures the entire surface without over-grinding minor depressions.	
☐		Ensure the texture is cut with parallel grooves between 0.09 and 0.13 inches wide, with a “land area” between grooves of 0.060 to 0.110 inches and a width between “peaks” of 1/16 inch.	
☐		Verify the pavement is restored to the original cross slope and a uniform cross slope is maintained, with checks at 100-foot intervals.	
☐		Confirm areas with deviations greater than ¼ inch in 12 feet are corrected.	
☐		Record test locations and results of the ride quality after diamond grinding in accordance with PUB 408 Section 507.3.	
☐		Ensure pavement surface roughness is tested in the longitudinal direction and results are submitted.	
☐		After diamond grinding the pavement surface, ensure the contractor provides a maximum IRI of 70 in/mile for facilities if posted speed limits are greater than 45 miles per hour, and a maximum IRI of 90 in/mile for facilities if posted speed limits are less than or equal to 45 miles per hour. Ensure these requirements are met in all IRI lots where diamond grinding of the pavement was performed to receive payment.	
☐		A full lot is 528 feet of a single lane. The Representative will designate lots starting at the beginning ride quality limit and continuing to the ending ride quality limit for each pavement lane and ramp 12 feet or wider. Do not include the length of excluded areas in the 528 feet. Excluded areas will consist of bridge decks, ramps less than 1,500 feet in length, tapered pavements less than 12 feet wide, partial lots less than 100 feet in length, shoulders, medians, existing pavement depressions identified as not corrected under the current contract, and other pavement surfaces.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Ensure the contractor cleans the entire roadway after the operation, prior to opening to traffic.	

AFTER LONGITUDINAL & TRANSVERSE GROOVING OF CONCRETE PAVEMENTS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the equipment calibrations and IRI measurements are obtained at the end of the day.	

Material & Equipment

There is no material for this operation.

The equipment for this work includes a PennDOT-approved milling machine or other grooving equipment.

For diamond grinding, the contractor uses equipment such as a pavement profile grinder or milling machine with diamond blades, as well as equipment to test longitudinal surface roughness (e.g., high-speed profiler).

Mechanical:				
Pavement Profile Grinder	Vacuum Truck	Water Truck		
Hand Tools:				
Concrete Broom	Squeegee			
Testing/Inspection:				
12-foot Straight Edge	High Speed Profiler			

Construction Methods

The contractor must perform longitudinal grooving, diamond grinding, and transverse grooving in accordance with the contract plans and PUB 408 Sections 509, 510, 512, 514, and 517 specifications. In addition, traffic control must be in place before work begins.

Next Generation Concrete Surface

Use a power-driven, self-propelled machine utilizing diamond blades capable of grinding and grooving the concrete pavement. The grinding equipment must weigh a minimum of 40,000 pounds when equipped with a grinding head capable of making a single pass, a minimum of 4 feet in width. Do not use grinding equipment that causes spalls at joints or cracks or fractures surface aggregates. Perform a feather pass on adjacent shoulders and ramps to maintain consistent cross slope and drainage.

Longitudinal Grooving

Using approved equipment, the contractor grinds the pavement to the required depths without grinding bridge decks or traffic control patterns. The slurry is removed as the operation continues. Do not cut longitudinal grooves into bridge decks or within 6 inches of the outside edge and centerline pavement joints.

Diamond Grinding

Using approved equipment, the contractor grinds the pavement surface to provide a uniform cross slope. The slurry is removed as the operation proceeds, and deviations are corrected. Operate the grinding machine parallel to the centerline, ensuring the entire pavement is textured. Do not perform extra depth grinding to eliminate minor depressions. Do not grid within 2 feet of existing curbs or barriers. Do not exceed 2 inches of overlap when making multiple passes.

Transverse Grooving

Using approved equipment, transverse grooving is applied to the pavement surface as indicated. The slurry is removed as the operation continues. Do not overlap or cut grooves within 6 inches of the outside edge or centerline pavement joint.

Measuring & Payment Methods

Payments for NGCS, longitudinal grooving, diamond grinding, and transverse grooving are made by the square yard, as measured on the ground or grooved area.

An incentive payment might be made for diamond grooving if the minimum IRI specified in PUB 408 Section 507 is attained.

6. PRESSURE RELIEF JOINT, JOINT & CRACK CLEANING, SEALING, & REHAB (SEC. 511, 512, 513, 521, 590)

This section addresses the construction of a pressure relief joint, cleaning and sealing of longitudinal joints and transverse joints, joint rehabilitation (Type 1 and Type 2), and crack cleaning and sealing.

Pressure Relief Joint

This work is the construction of a pavement pressure relief joint in accordance with PUB 408 Section 511.

Longitudinal Joint Cleaning & Sealing

This work is cleaning and sealing longitudinal joints in existing cement concrete pavements in accordance with PUB 408 Section 512.

Joint Rehabilitation

This work is the construction of a sealant reservoir and sealing transverse contraction, construction, or expansion joints in existing Portland cement concrete pavements in accordance with PUB 408 Section 513.

- 1) **Type 1:** Joint rehabilitation of existing saw-cut joints.
- 2) **Type 2:** Joint rehabilitation of existing metal plate joints.

Transverse Joint Cleaning & Sealing

This work is the cleaning and sealing of existing transverse joints in cement concrete pavements and shoulders in accordance with PUB 408 Section 521.

Crack Cleaning & Sealing

This work is cleaning and sealing cracks in existing cement concrete pavements having an opening of 1/16 inch and wider in accordance with PUB 408 Section 590.

☐ Review  Documentation Required

BEFORE PRESSURE RELIEF JOINT, JOINT & CRACK CLEANING, SEALING, & REHAB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos

DURING PRESSURE RELIEF JOINT, JOINT & CRACK CLEANING, SEALING, & REHAB CHECKLIST

☐		Task	Reference
Pressure Relief Joint			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor saws a joint opening 4 inches wide, full-depth, and full width.	
☐		Verify the existing concrete material is removed.	
☐		Confirm that all vertical surfaces are sandblasted and cleaned with 100 psi compressed air immediately.	
☐		Ensure the sealing material is placed according to the manufacturer's recommendations.	
☐		Verify the contractor coats the joint sides with either sealant or lubricant adhesive, according to the manufacturer's recommendations.	
☐		Collect truck delivery tickets for materials.	eTicketing
Longitudinal Joint Cleaning & Sealing			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor cleans the longitudinal joints of all existing sealing material and other foreign materials through sawing, sandblasting, or water blasting.	
☐		Verify the contractor cleans the existing saw cuts to a depth of 1½ inches.	
☐		Confirm the original formed construction joints are cleaned to a depth of ¾ inch.	
☐		If a saw is used, ensure joints are flushed with water.	
☐		Verify the joints are dry and blown clean with compressed air prior to applying joint sealant materials.	
☐		Confirm the wipe test is performed prior to placement of joint sealing material per PUB 19 PTM 643.	

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☐		Task	Reference
☐		Ensure joint sealing material is in accordance with PUB 408 Section 705.4.	
☐		Verify the joint sealant is 1/8 to 1/4 inches below the pavement surface.	
Joint Rehabilitation			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure all joint rehabilitation work occurs after all spall repairs at the joint are completed.	
☐		Verify all unrepaired spalls 2 inches or smaller are cleaned and sealed.	
☐		Confirm the contractor saws the joint sealant reservoir to the depth and width required, centered on the existing joint.	
☐		Ensure the joint is flushed with water after the cut.	
☐		Verify bond breaker tape is placed on the bottom of the joint reservoir, extending no more than 1/8 inch up the reservoir face.	
☐		If an existing joint is wider than the required reservoir width, ensure it is cleaned to the depth required, in accordance with PUB 72M RC Standard 26M, and the vertical face is water blasted or sandblasted rather than saw cut.	
☐		Verify the joints are dry and blown clean with compressed air prior to applying joint sealant materials.	
☐		Ensure joint sealing material is in accordance with PUB 408 Section 705.4.	
☐		In Type 2 repairs, if the existing steel plate extends into the new joint sealant reservoir by more than 1/4 inch, ensure it is removed.	
☐		Verify any damage to the existing shoulders is repaired.	
Transverse Joint Cleaning & Sealing			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor cleans the transverse joints of all existing sealing material and other foreign material through sawing, sandblasting, or water blasting.	

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☐		Task	Reference
☐		Verify transverse joints are cleaned to a depth of 1½ inches to provide a clean, newly exposed concrete surface.	
☐		Confirm sealant is not applied unless the ambient air temperature is 40F or greater.	
☐		Before placing the backer rod, ensure the vertical faces of the joint are cleaned by sandblasting and air blasting.	
☐		Verify the backer rod is placed to a depth of 1 inch below the pavement surface prior to sealing the joint and is 1/8 inch larger in diameter than the joint opening.	
☐		Confirm joints are cleaned and dried before the sealant is placed.	
☐		Ensure the joint is filled to a level of 1/8 to ¼ inches below the pavement surface.	
Crack Cleaning & Sealing			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor saws or grinds cracks to a width of ¾ inch wide and a depth of 1 inch. If the original crack is between ¾ and 1 inch wide, ensure the contractor saws or grinds to a width of 1 inch and depth of 1 ¼ inches.	
☐		Verify the cracks are flushed with water immediately after sawing or grinding but are not sealed on the same day.	
☐		Confirm the crack is dry and blown clean with compressed air prior to applying sealant materials.	
☐		Ensure cracks are filled to a level of 1/8 to ¼ inch below the pavement surface.	

AFTER PRESSURE RELIEF JOINT, JOINT & CRACK CLEANING, SEALING, & REHAB CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Some of the materials required, such as joint sealant, joint backing material, and tape bond breaker, must meet the requirements of the applicable PUB 408 Sections 705 and 708. All materials must be from an approved supplier.

The primary equipment for this work is a concrete saw, sandblaster, water blaster, air compressor, and equipment used to place joint material.

Mechanical:				
Abrasive Blasting Machine	Air Compressor	Concrete Mixer Truck	Concrete Saw	Jackhammer
Pressure Washer	Sand Blaster	Water Blaster		
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Crack Filler Applicator	Screed	Shovel	Trowel	
Testing/Inspection:				
Tape Measure				

Construction Methods**Pressure Relief Joint**

The joint is saw cut to the full-depth and width of the pavement. The area is sandblasted and clean, and an approved sealing material or lubricant adhesive is applied.

Longitudinal Joint Cleaning & Sealing

Existing material is removed from the joints, which are then cleaned and flushed as necessary. When the joint is dry and cleaned, the contractor applies the approved sealant.

Joint Rehabilitation

The contractor repairs the appropriate spalls, then saw cuts a joint sealer reservoir. After the joint is flushed, a bond breaker is installed, the joint is cleaned, and an approved sealant is applied.

Transverse Joint Cleaning & Sealing

Existing material is removed from the joints, which are then cleaned and flushed as necessary. When the joint is dry and cleaned, the contractor installs the appropriate-sized backer rod and then applies the approved sealant.

Crack Cleaning & Sealing

The contractor saw cuts or grinds the cracks as required. The cracks are then flushed and cleaned, and the appropriate sealer is applied.

Measuring & Payment Methods

Payment for these items of work is made by the linear foot.

The payment for joint rehabilitation includes the cleaning and sealing of small, unrepaired spalls.

Any shoulder damage is repaired at no cost to the Department.

7. SAWING & SEALING OF ASPHALT OVERLAYS (SEC. 515)

This section addresses the saw cutting of new asphalt courses directly above existing or constructed transverse joints (in the underlying concrete pavement) and sealing the reservoir.

☐ Review  Documentation Required

BEFORE SAWING & SEALING OF ASPHALT OVERLAYS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch applicable training videos for the sawing and sealing of asphalt overlays operations.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Ensure all existing transverse joints are located and referenced prior to placing asphalt courses.	

DURING SAWING & SEALING OF ASPHALT OVERLAYS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure joints are accurately located to make saw cuts directly above existing transverse joints within ± 1 inch.	
☐	Verify saw cuts are made after asphalt courses have cooled below 140F and within seven days of the placement of the wearing course.	
☐	Confirm saw cuts are only made in the lane with existing joints and are extended through all widening.	
☐	Ensure separate cuts are made when joints in adjacent lanes are more than 1 inch apart.	
☐	If the wearing course is to be placed in the following construction season, ensure saw cuts 1 inch deep and 1/8-inch wide are made	

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☐		Task	Reference
		in the last placed asphalt course or 1/3-thickness of asphalt material placed, whichever is greater, per PUB 408 Section 515.	
☐		If wet sawing, ensure the cut is flushed with water.	
☐		Verify sealing material is placed when reservoir surfaces are clean and dry, not on the same day as saw cuts.	
☐		Confirm the cut is dry and blown clean with compressed air before applying sealant materials.	
☐		Ensure sealing is only done if the air temperature is above 40F and below 90F.	
☐		Verify the sealant is heated and applied within the manufacturer's recommendations, ensuring a batch is heated for no more than six hours.	
☐		Confirm bond breaker tape is placed immediately before placing a sealant.	
☐		Ensure the sealant reservoir is filled to a level of 1/8 to 1/4 inches below the pavement surface.	
☐		Verify the contractor prevents material from spreading over the pavement surface.	
☐		Collect truck delivery tickets for materials.	eTicketing

AFTER SAWING & SEALING OF ASPHALT OVERLAYS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The materials for the work include approved sealing material and bond breaker tape. All materials must be from an approved supplier.

The contractor typically uses a concrete saw to saw the joints and a tar buggy or a distributor truck to heat and place the joint sealant material.

Mechanical:				
Air Compressor	Concrete Saw	Flatbed Truck	Tar Buggy	Water Truck

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Hand Tools:				
Asphalt Spray Wand	Water Hose			
Testing/Inspection:				
Tape Measure				

Construction Methods

Before placing the asphalt material, the contractor identifies and marks existing transverse joints. After the asphalt material has cooled, saw cuts and reservoirs are created according to PUB 408 Section 515 specifications.

The contractor then cleans and flushes the joint, applies bond breaker tape, and seals the joints.

Measuring & Payment Methods

Sawing and sealing are paid for by the linear foot as one item.

8. CONCRETE PAVEMENT PATCHING (SEC. 516 & 518)

This section addresses the construction of one course, full-depth, normal strength, and accelerated strength cement concrete pavement patches and continuously reinforced concrete pavement patching. Patching is performed in a minimum of one-lane widths. If diamond grinding is to be incorporated into the work, the pavement surface is tested in the longitudinal direction as specified.

The work may include patching existing or new pavement joints. It may also include normal and accelerated concrete for pavement patching and continuously reinforced concrete pavement patching of three types:

- 1) **Type A:** patches between 6 and 20 feet long
- 2) **Type B:** patches between 20.1 and 65 feet long
- 3) **Type C:** patches between 65.1 and 500 feet long.

☐ Review

 Documentation Required

BEFORE CONCRETE PAVEMENT PATCHING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure patches are marked as directed in advance of the sawing operation.	

DURING CONCRETE PAVEMENT PATCHING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	

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☐		Task	Reference
☐		Ensure patches are not open longer than 48 hours or over weekends or holidays.	
☐		If rain is forecasted, verify outlets are made in the shoulder to drain water from the patch. Shoulder repairs are made at no cost to the Department.	
☐		Confirm traffic is only permitted to travel on saw cut patches for a maximum of 72 hours.	
☐		Ensure a full-depth saw cut is made in the existing longitudinal joint if only one lane is to be patched.	
☐		If two lanes are to be patched (at different times), verify a saw cut is made parallel to the longitudinal joint 1 foot into the adjacent lane to form a new longitudinal joint or in the existing joint and verify bond breaker material is placed between the slabs before patching.	
☐		Confirm full-depth transverse saw cuts are made as indicated. If spalling occurs, ensure a new saw cut is made beyond the area of the break and patched at no additional cost.	
☐		For continuously reinforced patches, ensure a full-depth transverse saw cut is made from the outside edge of the pavement toward the longitudinal saw cut. Ensure a second 1-inch depth saw cut is made at the end of the patch area, parallel to and outside the initial saw cut distance shown on the standard drawings (for the type of splices used) and PUB 408 Section 518.	
☐		For continuously reinforced patches, verify the saw cuts do not cross or are within 24 inches of an existing crack per PUB 408 Section 518. Verify existing reinforcing steel is not cut.	
☐		For continuously reinforced patches, confirm the concrete between full-depth saw cuts is removed before making the 1-inch depth saw cut per PUB 408 Section 518. The contractor may make additional saw cuts within the limits to facilitate removal.	
☐		For continuously reinforced patches, ensure the concrete below the 1-inch depth cut is removed to expose rebar. If the rebar is damaged or cut, ensure a cutback is performed and the depth cut operation is repeated at no additional cost per PUB 408 Section 518.	
☐		Verify the concrete is removed without disturbing the subbase, subgrade, or damaging any adjacent pavement that is to remain in place.	
☐		If a wheel saw is used to make cuts, confirm these cuts do not extend into the roadway that is to remain, and the contractor	

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☐		Task	Reference
		discontinues using the wheel saw if unsatisfactory results are determined per PUB 408 Section 518.	
☐		Ensure drop hammers and hydro hammers are not used per PUB 408 Section 516.	
☐		Ensure disturbances to the existing subbase of less than 1 inch are repaired by grading and compacting with a small vibratory compactor per PUB 408 Section 516.	
☐		If the disturbance is greater than 1 inch, verify the subbase is removed and replaced with the concrete used in the patching operation.	
☐		Confirm unsuitable subbase is removed and replaced as directed.	
☐		If a patch is replacing an existing expansion joint and the expansion joint in the lane is to remain, ensure $\frac{3}{4}$ inch of expansion joint material is installed in the joint nearest to the remaining expansion joint as specified in PUB 408 Section 516.	
☐		Verify a tube with a 1-inch clearance over the lubricated end of all coated dowel bars is per PUB 408 Section 518.	
☐		Confirm holes for patching joints are drilled into the face of the existing pavement at the depth indicated in the standards and are 1/8 inch larger than the coated dowel bars. A drilling frame that provides proper horizontal and vertical alignment should be used.	
☐		For continuously reinforced patches, ensure rebar is placed in the patch as specified in the standard drawings and bars are supported and tied at every intersection to reestablish the continuous reinforcing per PUB 408 Section 518. Verify ties or welded splices are used in this operation.	
☐		Verify hand drills or drills that rest on the subbase are not used.	
☐		Confirm hole locations are adjusted to avoid rebar per PUB 408 Section 518.	
☐		Ensure anchoring material is injected into the hole and the coated dowel bar is inserted. Ensure the bar is rotated three to five times to purge air voids as completely as possible.	
☐		Verify a plastic retainer washer is placed to hold anchoring material in place and ensure the plastic retainer washer and excess material are removed prior to the concrete pour to provide a clean vertical surface.	

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☐		Task	Reference
☐		Verify the contractor provides anchoring material formulated to reach initial sets within five minutes.	
☐		In new pavement joints, as indicated and when directed, confirm load transfer units are placed adjacent to and at the same spacing as existing joints per PUB 72M RC Standards 21M, 26M, and 27M.	
☐		Ensure full-depth steel or wood forms are used to form the edge of patches not in contact with existing pavements.	
☐		If not being overlaid, verify type A and B patches are finished to match the existing pavement cross section, including wheel ruts. In type C patches, ensure wheel ruts are located at either end of the patch.	
☐		Confirm type A and B patches are textured in the same manner as the surrounding pavement and type C patches are textured as new pavement.	
☐		If grinding is in the contract, finishing the patches with wheel ruts and texture is not necessary.	
☐		Ensure the date of patch placement is scribed on the shoulder of each patch.	
☐		Verify concrete is cured immediately after placement and that care is taken to avoid marring the surface.	
☐		Confirm monomolecular film cure is applied to the entire surface of the patch.	
☐		Ensure the patch is covered with saturated burlap and the burlap is covered with plastic.	
☐		Verify adjoining sheets of curing materials are overlapped 12 inches or more.	
☐		Confirm curing is maintained for at least 96 hours or until minimum compression strength is met per PUB 408 Section 501.3, and curing is removed only to saw joints or to test ride performance and is replaced after these activities.	
☐		If the air temperature is above 40F, a white Poly-alpha-methyl styrene (PAMS) liquid membrane forming curing compound can be used.	
☐		Ensure cold weather curing is performed as needed per PUB 408 Section 501.3.	

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☐		Task	Reference
☐		In two-lane width patching being performed at the same time, verify a Type L joint is constructed as shown on PUB 72M RC Standard 20M.	
☐		In two-lane patching being performed one lane at a time or one-lane patching, ensure a ¼-inch, full-depth, polystyrene board bond breaker is placed in the longitudinal joint of type A and B patches and corner repairs.	
☐		Verify a bond breaker is not placed in the longitudinal joint of type C patches.	
☐		Confirm tie bars are installed in all type C patches.	
☐		For all patch types, ensure the longitudinal joint is saw cut ¼ inch wide and 1 inch deep, centering the saw cut over the joint.	
☐		Verify all constructed joints are sealed as part of the patching operation, except with patches that are to be overlaid. For these patches, only expansion joint sealing is necessary.	
☐		Confirm all saw cuts extending beyond the patches are sealed.	
☐		If the pavement is not to be overlaid in the same construction season, ensure a sealant reservoir is constructed and joints are sealed per PUB 408 Section 501.3.	
☐		Longitudinal and transverse joints of accelerated-strength concrete patches may be opened to traffic, provided second-stage sawing has not occurred. Verify a backer rod is installed and maintained near the surface, initial concrete strength is attained, and curing requirements are met.	
☐		Ensure the contractor performs second-stage sawing and sealing the joints of accelerated strength concrete patches, as specified in PUB 408 Section 501.3, within 24 hours.	
☐		Verify the surface area of the patches is tested with a 12-foot straight edge noting all high points or depressions of more than 3/16 inches unless caused by a surface deficiency in the existing adjacent pavement.	
☐		After grinding, verify the area is retested with the straight edge. If the surface still exceeds the above limits, then the area is defective.	
☐		When opening the patches to traffic, ensure the contractor follows PUB 408 Section 501.3.	

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☐		Task	Reference
☐		When rapid set concrete materials are used for patching repairs, verify the QC cylinders are cured according to the manufacturer's recommendations.	
☐		When rapid set concrete materials are used for patching repairs, the Department Representative will determine when pavement may be opened to traffic based on when the concrete attains the minimum required compressive strength of 1,000 pounds per square inch as measured by compressive strength testing of cylinders according to PUB 19 PTM 604.	
☐		Document all concrete testing performed and all concrete placed.	eConcrete
☐		Collect truck delivery tickets for materials.	eTicketing

AFTER CONCRETE PAVEMENT PATCHING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The contractor uses a variety of materials in plain or reinforced concrete pavement patching. Depending upon the type of patching, these include Class AA cement concrete, reinforcing steel, expansion joint filler, dowels, load transfer units, joint sealer, graphite lubricant, concrete cure, subbase, anchors, and welding material. All materials must be from an approved source of supply.

Specifications for normal-strength concrete are found in PUB 408 Section 704. Specifications for accelerated-strength concrete are found in PUB 408 Section 704 (ignoring Table A). Accelerated concrete must have a 28-day compressive strength of 3,750 psi, and the contractor must submit a mix design with a minimum target compressive strength of 1500 psi after seven hours.

For patching operations, the contractor needs a concrete saw, concrete drilling equipment, equipment to remove existing concrete such as a crane or an excavator, compaction equipment such as a vibrator plate compactor, to compact subbase, if necessary, steel or wood forms, and finishing equipment, such as a vibratory screed. Testing equipment meeting the requirements of PUB 408 Section 704 is used to test all concrete.

Mechanical:				
Concrete Drill	Concrete Finisher	Concrete Mixer Truck	Concrete Saw	Crane
Excavator	Material Transfer Vehicle	Skid Steer	Tri-Axle Dump Truck	Vibratory Plate Compactor

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Vibratory Steel Wheel Roller				
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Hammer	Screed	Shovel	Trowel
Testing/Inspection:				
12-foot Straight Edge	Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level

Construction Methods

In advance of the operation, a Department Representative marks the patch limits. The contractor then saws the limits of the patch. Sometimes, the contractor will make additional cuts within the patch to expedite material removal. Using a lifting device and other equipment, the existing concrete is lifted out, and care is taken not to disturb the subbase or subgrade.

On the first day of dowel bar anchoring operations, the Representative will randomly select three locations to evaluate the proper anchoring of dowel bars to provide load transfer across the joint without deflection and to prevent moisture intrusion. At each location, drill one 4-inch diameter core directly through the anchored dowel no closer than 3 inches from the joint face.

The Representative will determine if the anchoring of the dowels is acceptable. Acceptance will be the summation of voids around the perimeter of the dowel less than ½ inch. If the anchoring of the dowels is acceptable, continue production using the same anchoring operations. If the anchoring of the dowels is unacceptable, additional evaluations of dowel bar anchoring operations will be conducted. Construct a new patching joint offset 2 feet from each joint determined not acceptable at no additional cost to the Department.

Clean the vertical surface of any core hole of laitance, loose, and foreign material. Fill the holes with the concrete mixture used to construct the pavement and consolidate. As an alternative, use a premixed, non-shrink grout.

The unsuitable subbase is removed and replaced. Expansion material is installed as required. If the patch includes a transverse joint, the existing concrete is drilled, and dowels are installed per standards. Continuously reinforced patches require the installation of rebar.

Forms of steel or wood are used for the patch. The contractor's certified technician tests the concrete, and the concrete is then placed. After placement, the concrete is finished using either a vibratory screen or other finishing equipment, depending on the length of the patch.

Measuring & Payment Methods

Patching existing and new joints is paid for by the linear foot, while plain and reinforced cement concrete pavement patching is paid for by the square yard. Subbase is paid by the cubic yard, with excavation included in the unit price.

When joint cleaning and sealing is part of the contract, sealing of longitudinal joints is incidental to that item, not to concrete pavement patching.

9. CONCRETE PAVEMENT OVERLAYS (SEC. 540, 541, 545, & 548)

This section addresses the construction of the various types of concrete overlays described below.

Bonded Concrete Overlay of Asphalt-Surfaced Pavement

This work is the construction of a Portland cement concrete overlay with a thickness of 4 to 8 inches and is bonded to an existing asphalt-surfaced pavement. It includes asphalt surface preparation, overlay construction, construction of transitions, joint sawing and sealing, and other construction details, as indicated and per PUB 408 Section 540 specifications.

Thin Bonded Concrete Overlay of Asphalt-Surfaced Pavement

This work is the construction of a thin Portland cement concrete overlay with a thickness of 2.5 to 4 inches and is bonded to an existing asphalt-surfaced pavement, per PUB 408 Section 541 specifications.

Bonded Concrete Overlay of Concrete-Surfaced Pavement

This work is the construction of a bonded concrete overlay, or inlay, of concrete pavements, including surface preparation and joint sawing and sealing, per PUB 408 Section 545 specifications.

Unbonded Concrete Overlay of Concrete-Surfaced Pavement

This work is the construction of an unbonded concrete overlay of concrete pavements, including surface preparation and joint sawing and sealing, per PUB 408 Section 548 specifications.

☐ Review

 Documentation Required

BEFORE CONCRETE PAVEMENT OVERLAYS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review the approved comprehensive QC plan in advance of the start of construction.	MCDocs

DURING CONCRETE PAVEMENT OVERLAYS CHECKLIST

☐		Task	Reference
Bonded & Thin Bonded Concrete Overlay of Asphalt-Surfaced Pavement			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		Ensure the existing asphalt pavement surface is milled to the depth indicated in the plans as specified in PUB 408 Section 492.	
☐		Verify any unsound pavement is removed and replaced with AA concrete in conjunction with the overlay operation.	
☐		Confirm cracks greater than 3/4 inches are filled with non-shrink grout or other material approved by the Department, which will enable the bond to the concrete overlay before pavement surface cleaning.	
☐		Ensure standing water does not remain on the surface after the milling operation. If standing water occurs, verify the contractor immediately provides measures acceptable to the Department to drain the water from the milled surface.	
☐		Verify the milled pavement surface is completely cleaned to remove all loose debris and that the final cleaning of the surface occurs no more than 30 minutes before the placement of the concrete.	
☐		Immediately before placing the concrete overlay, confirm the asphalt surface is less than 120F. Fog-misting, protective covers, or blankets will be allowed to achieve the proper condition of the surface, but do not allow any standing water or moisture to remain on the pavement surface.	
☐		Ensure joints are spaced as indicated on the project plans and special provisions.	
☐		If no joint spacing is indicated, verify the contractor develops a joint layout plan to be accepted by the Department and ensure the joints are laid out per the approved plan before placement of concrete.	
☐		Ensure joints are sawn as soon as the concrete has sufficiently hardened to permit sawing without excessive raveling and to prevent random cracking. Sawing is the only acceptable technique for creating concrete overlay joints.	
☐		Confirm sawing operations are conducted continuously, day and night, regardless of weather conditions, if necessary.	

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☐		Task	Reference
☐		Ensure joints are sawn with a green cut saw to a depth of D/3 and a minimum width of 1/8 inch.	
☐		If initial saw cuts do not extend through the slab edge to avoid “blowouts” or edge damage of green concrete, verify these cuts extend through the edge as soon as they can be done without causing damage.	
☐		Confirm joints are cleaned of all deleterious material after sawing and that they are not sealed.	
☐		If the pavement is cured by means other than white-pigmented, liquid membrane-forming curing compound, ensure curing materials are only removed from the overlay at the location where a joint is to be cut and only sufficient covering is removed to provide space necessary for sawing joints. As soon as the joint is made, ensure the covering is replaced.	
☐		Verify that the pavement curing covers are removed for 30 minutes maximum.	
☐		If a white-pigmented liquid membrane-forming curing compound is used, confirm the joint area is cured as specified in PUB 408 Section 501.3.	
☐		Ensure transitions are constructed at the limits of the concrete overlay as indicated in the plans.	
☐		In areas where transitions contain existing treated base course or concrete pavement directly below the overlay, verify geotextile is placed as a debonding layer as specified in PUB 408 Section 212.	
☐		Ensure curing materials are applied after finishing and texturing operations and within 30 minutes of the dissipation of bleed water and maintain them in place until the pavement has reached sufficient strength as specified in PUB 408 Section 540.3 for opening to traffic.	
☐		Verify the contractor provides adequate insulating blankets to prevent rapid heat loss if the air temperature is 45F or less. Insulation may be removed when the air temperature exceeds 45F or when the average compressive strength of the concrete exceeds 3,000 pounds per square inch.	
☐		Confirm insulation is removed in a manner such that the rate of temperature change at the concrete surface does not exceed 40F within a 1-hour period. Concrete that experiences a higher rate of temperature change will be considered defective.	

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□		Task	Reference
□		Ensure the curing compound is applied homogenously to provide a uniform, solid white opaque coverage on all exposed concrete surfaces. Verify the curing compound is applied at a minimum rate of 1 gallon ($\pm$ 0.1 gallon) per 125 square feet or as specified by the manufacturer's recommendations, whichever is greater.	
□		Verify all transverse and longitudinal joints are sealed with an approved hot-pour or silicone sealant material in accordance with the manufacturer's recommendations and as specified in PUB 408 Section 501.3.	
□		Confirm the pavement is not opened to traffic until the concrete attains the minimum required compressive strength of 3,000 pounds per square inch as measured either by compressive strength testing of cylinders in accordance with PUB 19 PTM 604 or by the maturity method per PTM 640.	
□		<u>Tests for Depth.</u> Before final acceptance of each phase of the project, proceed as follows: Divide the concrete overlay pavement into lots representing not more than 3,000 square yards of pavement in each traffic lane.	
□		<u>Tests for Depth.</u> Before final acceptance of each phase of the project, proceed as follows: Select one coring location at random within each lot according to PUB 19 PTM 1 and verify the cores are drilled according to PTM 606.	
□		<u>Tests for Depth.</u> Before final acceptance of each phase of the project, proceed as follows: For projects at intersections or less than 3,000 square yards, ensure two cores are drilled.	
□		<u>Tests for Depth.</u> Before final acceptance of each phase of the project, proceed as follows: Verify the core hole is cleaned and free of all laitance, including the vertical surfaces, and ensure the holes are filled with the mixture used to construct the course or ensure non-shrink grout.	
□		<u>Tests for Depth.</u> Before final acceptance of each phase of the project, proceed as follows: Measure the core depth utilizing an approved measuring apparatus according to PUB 19 PTM 614.	
□		<u>Tests for Depth.</u> Before final acceptance of each phase of the project, proceed as follows: If a core measurement is deficient by more than $\frac{1}{4}$ inch in required depth, witness the additional cores being drilled at 100-foot intervals. Measure each core to determine when the depth is no more than $\frac{1}{4}$ inch deficient. Each core will represent the condition in the same traffic lane for 50 feet in both directions longitudinally.	

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☐		Task	Reference
☐		<u>For Thin Bonded Concrete Overlay of Asphalt Surfaced Pavement Tests for Depth Only:</u> Other methods of non-destructive thickness testing may be requested in writing for approval by the DE. Ensure only the approved type of testing is used.	
Bonded Concrete Overlay of Concrete-Surfaced Pavement			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		Ensure concrete is only placed when the concrete temperature is between 65 and 90F.	
☐		Verify the contractor utilizes a self-propelled mechanical scarifier capable of uniformly removing the old surface across the entire cutting path to the depth indicated, as specified in Section PUB 408 Section 591.3.	
☐		Confirm shot blasting or water blasting equipment capable of removing any loose concrete and rust from exposed reinforcement is provided by the contractor.	
☐		When used to lower the pavement elevation, confirm the existing pavement surface is scarified to the depth indicated in the contract documents.	
☐		Ensure any exposed or loose reinforcement is cut off and removed.	
☐		After scarifying, verify any deteriorated concrete or asphalt materials that extend below the level of the scarification are removed as indicated or directed.	
☐		Confirm all full-depth asphalt patches are replaced with concrete as specified in PUB 408 Section 516.	
☐		If inlaying and the existing transverse pavement joints have steel plates, ensure the exposed steel plates are removed.	
☐		Verify shot blasting or water blasting is performed to produce a roughened surface following the milling.	
☐		Confirm standing water is removed in a manner acceptable to the Department.	

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□		Task	Reference
□		Verify the milled pavement surface is completely cleaned to remove all loose debris and that the final cleaning of the surface occurs no more than 30 minutes before the placement of the concrete.	
□		Verify joint backing or other approved joint filling material is installed to within $\pm \frac{1}{4}$ inch of the pavement surface in all existing transverse joints (including those associated with full-depth repairs) before placement of the overlay. Ensure that the joint backing or filling material cannot be dislodged by the paving operation.	
□		Immediately before placing the concrete overlay/inlay, confirm the surface is less than 120F. Fog-misting, protective covers, or blankets will be allowed to achieve the proper temperature and moisture conditions of the surface.	
□		Ensure standing water is blown from the pavement surface before starting overlay operations.	
□		Verify paving notches are constructed as indicated and per the PUB 72M RC Standard 28M.	
□		Ensure the contractor accurately marks the location of all transverse joints with the use of guide nails, tacks, or other Department Representative-approved devices to accurately mark the locations of the centers of all transverse joints before placing the concrete overlay so that they can be located after the overlay has been placed.	
□		Tests for Depth. Before final acceptance of each phase of the project, proceed as follows: After the surface preparation has been completed and before placement of the overlay, test the prepared surface. Verify bond strength testing is performed at 7 days, according to ASTM C1583.	
□		Tests for Depth. Before final acceptance of each phase of the project, proceed as follows: For each area represented by each day's placement of not more than 3,000 square yards, select five test locations at random, according to PUB 19 PTM 1, and test according to ASTM C1583.	
□		Tests for Depth. Before final acceptance of each phase of the project, proceed as follows: If the average of the test results on the three tests is below 175 pounds per square inch and each test has a minimum strength of 160 pounds per square inch, the area represented will be considered defective. If defective, ensure additional tests are obtained at 100-foot intervals in both directions longitudinally from the defective locations to determine the limits of defective work. Each set of three defective tests will represent the	

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☐		Task	Reference
		condition in the same traffic lane for 50 feet in both directions longitudinally.	
☐		Verify the final finish is applied according to PUB 408 Section 501.3.	
☐		Ensure curing materials are applied after finishing and texturing operations and within 30 minutes of the dissipation of bleed water and maintain them in place until the pavement has reached sufficient strength as specified in PUB 408 Section 545.3 for opening to traffic.	
☐		Verify the contractor provides adequate insulating blankets to prevent rapid heat loss if the air temperature is 45F or less. Insulation may be removed when the air temperature exceeds 45F or when the average compressive strength of the concrete exceeds 3,000 pounds per square inch.	
☐		Confirm insulation is removed in a manner such that the rate of temperature change at the concrete surface does not exceed 40F within a 1-hour period. Concrete that experiences a higher rate of temperature change will be considered defective.	
☐		Ensure the curing compound is applied homogenously to provide a uniform, solid white opaque coverage on all exposed concrete surfaces. Verify the curing compound is applied at a minimum rate of 1 gallon ($\pm$ 0.1 gallon) per 125 square feet or as specified by the manufacturer's recommendations, whichever is greater.	
☐		As soon as the concrete is strong enough for cutting the joints without significant raveling or chipping, verify transverse joints are cut directly over all existing transverse joints, including those produced by pre-overlay repairs.	
☐		Confirm saw cut depth is equal to the full thickness of the overlay, including any additional thickness used for grade corrections, plus $\frac{1}{2}$ inch, but must not result in damage to dowel load transfer devices in the original pavement.	
☐		To prevent debonding, ensure the saw cut width is at least the width of the underlying joint or crack in the existing pavement or greater. Measure joint widths immediately before placement of the overlay/inlay.	
☐		When inlaying, verify transverse joints are saw cut to the full depth of the inlay, including any extra depth concrete placed at the joint, directly over the existing transverse joint, and a minimum of $\frac{1}{2}$ inch wide.	

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□		Task	Reference
□		Confirm a sealant reservoir is constructed, as shown on PUB 72M RC Standard 20M. The overlay may be sawed in a second operation or make the initial saw cut equal to the required reservoir width.	
□		After sawing, ensure the joint is immediately flushed with water to remove the sawing slurry that might otherwise prevent proper sealant installation.	
□		Verify backing material is placed to the proper depth and seal the joints, as specified in PUB 408 Section 501.3.	
□		Ensure intermediate transverse joints are cut between existing transverse joints so the overlay panel length does not exceed 15 feet. Verify the saw cut depth is equal to the full thickness of the overlay, including any additional thickness used for grade corrections, plus ½ inch.	
□		Verify the contractor accurately references the location of existing longitudinal joints within the overlay area and between the adjacent lane and the overlay area so that they can be located after paving.	
□		After paving, confirm a sealant reservoir is cut ¼ inch wide and the full depth of the overlay plus ½ inch directly over the existing longitudinal joint.	
□		Ensure joints are sealed as specified in PUB 408 Section 501.3.	
□		Verify the maximum edge slump in the outside 6 inches next to the shoulder is ¼ inch.	
□		Verify the maximum edge slump in the outside 6 inches next to an adjacent lane is 1/8 inch.	
□		Confirm the pavement is not opened to traffic until the concrete attains the minimum required compressive strength of 3,600 pounds per square inch as measured by compressive strength testing of cylinders in accordance with PUB 19 PTM 604 and the minimum acceptable bond strength as specified in PUB 408 Section 545.3.	
□		Ensure surface tolerance is within the specifications listed in PUB 408 Section 506.3.	
Unbonded Concrete Overlay of Concrete-Surfaced Pavement			
□		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
□		Ensure areas with unstable slabs and slab fragments (e.g., slabs or fragments that move or rock visibly under normal traffic loads) that	

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☐		Task	Reference
		would otherwise result in non-uniform support of the overlay are stabilized or repaired before placement of the interlayer material.	
☐		Verify surface defects are repaired with a patching material that consists of an asphalt material, a cementitious material, or a similar pavement repair material, meeting the approval of the Representative before placing the overlay.	
☐		When using a geotextile interlayer, confirm all surface defects measuring greater than 4 square inches and 1 inch deep in the surface of the traffic lanes are filled with patching material and compact to a flat, tight surface.	
☐		Ensure the pavement is swept to remove any loose debris by using a power broom, vacuum truck, or other approved means before applying the pavement interlayer.	
☐		Verify joints with greater than ¼-inch faulting are milled.	
☐		Confirm the geotextile is placed flat on the repaired and cleaned existing pavement surface.	
☐		Ensure the edges of the geotextile are overlapped by 8 inches ± 2 inches, not allowing more than three layers of the geotextile to overlay in any location.	
☐		Verify the rolling out of geotextile is performed to ensure good lapping practice and prevent folding or tearing by construction traffic.	
☐		Confirm the free edge of the geotextile interlayer is extended a minimum of 4 inches beyond the edge of the pavement.	
☐		Ensure the interlayer is terminated in a drainable layer or at a daylighted location (e.g., ditch fore slope) and the free drainage of the geotextile is not impaired.	
☐		Verify the geotextile is secured following the geotextile manufacturer's instructions.	
☐		Avoid allowing construction traffic on the geotextile whenever possible and delay geotextile installation on areas subject to potentially damaging traffic, such as crossovers, until immediately before concrete placement. Ensure the contractor minimizes sharp turns and braking on geotextiles.	
☐		Confirm the geotextile is kept clean and free of loose debris before overlay placement.	

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☐		Task	Reference
☐		Ensure the geotextile is dampened but not saturated before overlay placement. Do not allow the placement of the overlay if the surface temperature rises above 120F.	
☐		Verify a nominal depth of 1 inch of Superpave mix design is placed as specified in PUB 408 Section 410.3.	
☐		If joint faulting exceeds ½ inch, confirm a scratch course is placed at the joint or joints are milled/ground to reduce faulting.	
☐		Ensure the scratch course is compacted with a rubber tire roller.	
☐		Do not allow the placement of the overlay if the surface temperature rises above 120F. Verify the asphalt surface temperature is regulated by misting the surface, using a white-pigmented curing compound, whitewashing with lime water, or other methods approved by the Department Representative.	
☐		If dowel baskets are moving during the paving operation, ensure paving operations are suspended until a plan for securely anchoring the baskets is approved by the Department Representative and implemented.	
☐		Verify dowel bar basket shipping wires remain intact unless a Magnetic Tomography-Based Device is to be used for dowel placement verification.	
☐		Confirm dowel bar assemblies are secured with anchors to hold the dowel bars in the correct position and alignment while preventing movement during concrete placement.	
☐		Ensure the baskets are fastened to the substrate surface so they do not move vertically or horizontally more than ¼ inch.	
☐		Verify the contractor identifies and marks any transverse expansion joints in the existing pavement.	
☐		To allow for slab movement before sawing, ensure the contractor precuts the expansion joints in the plastic concrete.	
☐		As soon as sawing is possible, verify two full-depth cuts are sawn on each side of the precut joint following the edges of the underlying expansion joint and remove the concrete between the saw joints.	
☐		Confirm the dimensions of the unbonded concrete overlay panels are determined using lane geometry, concrete placement width, and the following guidance:	

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☐		Task	Reference								
		<table><tr><th>Unbonded Overlay Thickness</th><th>Maximum Nominal Panel Dimensions</th></tr><tr><td>> 6 inches to < 8 inches</td><td>6 ft × 6 ft</td></tr><tr><td>≥ 8 inches to ≤ 10 inches</td><td>12 ft × 12 ft</td></tr><tr><td>> 10 inches</td><td>12 ft × 15 ft</td></tr></table>	Unbonded Overlay Thickness	Maximum Nominal Panel Dimensions	> 6 inches to < 8 inches	6 ft × 6 ft	≥ 8 inches to ≤ 10 inches	12 ft × 12 ft	> 10 inches	12 ft × 15 ft	
Unbonded Overlay Thickness	Maximum Nominal Panel Dimensions										
> 6 inches to < 8 inches	6 ft × 6 ft										
≥ 8 inches to ≤ 10 inches	12 ft × 12 ft										
> 10 inches	12 ft × 15 ft										
☐		Ensure the saw cut depth is no less than D/3 within 12 inches of the pavement edges and must be no less than D/4 anywhere.									
☐		Verify joints are cleaned of all deleterious material after sawing.									
☐		Confirm all transverse and longitudinal joints are sealed.									
☐		Sawing is the only acceptable technique for creating concrete overlay joints. Ensure joints are sawn as soon as the concrete has sufficiently hardened to allow sawing without excessive raveling resulting from the sawing operation and prevent random cracking. The use of “early entry” saws is recommended.									
☐		Verify sawing operations are conducted continuously, both day and night, regardless of weather conditions.									
☐		Ensure joints are cut with a green cut saw to a depth of D/3 and a minimum width of ¼ inch.									
☐		If the pavement is cured by means other than white-pigmented, liquid membrane-forming curing compound, ensure curing materials are only removed from the overlay at the location where a joint is to be cut and only sufficient covering is removed to provide space necessary for sawing joints.									
☐		Verify that the pavement curing covers are removed for 30 minutes maximum.									
☐		If a white-pigmented liquid membrane-forming curing compound is used, confirm the joint area is cured as specified in PUB 408 Section 501.3.									
☐		Ensure curing materials are applied after finishing and texturing operations and within 30 minutes of the dissipation of bleed water and maintain them in place until the pavement has reached sufficient strength as specified in PUB 408 Section 548.3 for opening to traffic.									
☐		Verify the contractor provides adequate insulating blankets to prevent rapid heat loss if the air temperature is 40F or less.									

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☐		Task	Reference
		Insulation may be removed when the air temperature exceeds 40F or when the average compressive strength of the concrete exceeds 3,600 pounds per square inch.	
☐		Confirm insulation is removed in a manner such that the rate of temperature change at the concrete surface does not exceed 40F within a 1-hour period. Concrete that experiences a higher rate of temperature change will be considered defective.	
☐		Ensure white PAMS liquid membrane-forming curing compound is applied homogenously to provide a uniform, solid white opaque coverage on all exposed concrete surfaces. Verify curing compound is applied at a minimum rate of 1 gallon ($\pm$ 0.1 gallon) per 150 square feet for pavements > 6 inches and per 125 square feet for pavements $\leq$ 6 inches or according to the manufacturer's recommendations, whichever is greater.	

AFTER CONCRETE PAVEMENT OVERLAYS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document all concrete testing performed in the eConcrete, all concrete placed, batch mixer slips, and concrete delivery tickets were received.	eConcrete

Material & Equipment

Bonded Concrete Overlay of Asphalt-Surfaced Pavement

Materials for the work include Class AA cement concrete, expansion joint filler, tape bond breaker, joint backing materials, longitudinal joint material, load transfer units, joint sealing material, concrete curing material, concrete covering material, Class 4 geotextile (non-woven), type V epoxy bonding compound, and pre-mixed non-shrink grout.

Thin Bonded Concrete Overlay of Asphalt-Surfaced Pavement

The materials and construction methods used are similar to those in PUB 408 Section 540; however, Class AA cement concrete is reinforced with synthetic or steel microfibers according to PUB 408 Section 708.1. If the depth is less than 3 inches, the mix design requires No. 67 coarse aggregate instead of No. 57 coarse aggregate. Additional criteria for mix design acceptance of thin bonded concrete overlay of asphalt-surfaced pavement concrete includes a permeability requirement of less than or equal to 2,800 coulombs per AASHTO T-277.

Bonded Concrete Overlay of Concrete-Surfaced Pavement

This work consists of Class AA cement concrete containing No. 57, No. 67, or No. 8 coarse aggregate and excludes the use of slag aggregates, concrete covering materials, concrete curing materials, joint backing material, joint sealing material, and tape bond breakers.

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The design criteria for the AA cement concrete include a minimum cement factor of 530 pounds per cubic yard and a maximum cement factor of 600 pounds per cubic yard, with a target water-cement ratio of 0.40. Attention to the proposed concrete mix design is critical to ensuring these requirements are met.

Unbonded Concrete Overlay of Concrete-Surfaced Pavement

The required materials include a non-woven geotextile interlayer, geotextile securing devices, Superpave mixture design (standard construction of plant-mixed asphalt fine-graded courses), Class AA cement concrete, reinforcement, expansion joint filler, longitudinal joint material, load transfer units, joint sealing material, bond breaker lubricant, concrete curing material, mortar, tape bond breaker, type V epoxy bonding compound, joint backing material, fiberglass dowel sleeves, and pre-mixed non-shrink grout.

The equipment used for the bonded and unbonded asphalt pavement overlay includes a milling machine, concrete paver, concrete saws, tar buggys, and miscellaneous hand tools such as screeds, concrete bullfloats, shovels, and concrete vibrators.

The equipment used for the bonded and unbonded concrete pavement overlay includes a scarifying or abrasive blasting machine, pressure washers, concrete paver, tar buggys, concrete saws, and miscellaneous hand tools such as jackhammers, screeds, concrete bullfloats, shovels, and concrete vibrators.

Mechanical:				
Abrasive Blasting Machine	Air Compressor	Asphalt Paver	Concrete Mixer Truck	Concrete Paver
Concrete Saw	Jackhammer	Material Transfer Vehicle	Milling Machine	Power Broom
Pressure Washer	Scarifying Machine	Tar Buggy	Vacuum Truck	Vibratory Plate Compactor
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Crack Filler Applicator	Paving Lute	Screed	Shovel
Trowel				
Testing/Inspection:				
Bond Strength Testing Equipment	Concrete Testing Equipment	Infrared Thermometer	Measuring Wheel	Nuclear Gauge
Probe Thermometer	Smart Level			

Construction Methods

Bonded & Thin Bonded Concrete Overlay of Asphalt-Surfaced Pavement

The construction methods are similar for bonded and thin bonded concrete overlays. The contractor mills the existing asphalt pavement to the depth indicated on the plans and replaces unsound pavement with Class AA cement concrete. Saw cutting and chipping with pneumatic hammers are conducted in areas inaccessible to the milling machine. The milled pavement surface is thoroughly cleaned prior to applying bonding material and overlaying cement concrete pavement.

For thin bonded concrete overlay of asphalt surfaced pavement, the concrete overlay pavement is divided into lots representing not more than 3,000 square yards of pavement in each traffic lane. Test for depth cores at random selection per PUB 19 PTM 1 and are drilled per PUB 19 PTM 606.

Bonded Concrete Overlay of Concrete-Surfaced Pavement

The contractor scarifies the existing pavement with a self-propelled mechanical scarifier capable of uniformly removing the old surface across the entire cutting path to the depth indicated on the plans. Shot blasting, sandblasting, or water blasting equipment is performed to remove any loose concrete and rust from exposed reinforcement. The cleaned pavement surface is thoroughly cleaned prior to applying bonding material and overlaying cement concrete pavement.

Unbonded Concrete Overlay of Concrete-Surfaced Pavement

Areas with unstable slabs and slab fragments that would otherwise result in non-uniform support of the overlay must be stabilized or repaired before placement of the interlayer material. Repair surface defects with a patching material that consists of an asphalt material, a cementitious material, or a similar pavement repair material, meeting the approval of the Department Representative before placing the overlay.

To provide a separation layer to provide an unbonded condition, utilize one of the following types as specified in the contract documents.

- **Geotextile Interlayer:** A geotextile interlayer is placed flat on the repaired and cleaned existing pavement surface. Overlap edges of the geotextile by 8 inches $\pm$ 2 inches, ensuring that no more than three layers of the geotextile are overlayed in any location. Secure the geotextile following the geotextile manufacturer's instructions. Keep geotextile clean and free of loose debris before overlay placement. Dampen geotextile but do not saturate before overlay placement. Do not allow the surface temperature of the fabric to exceed 120F before the overlay placement.
- **Asphalt Interlayer:** Place a nominal depth of 1 inch of Superpave mix design as specified in PUB 408 Section 410.3. If joint faulting exceeds $\frac{1}{2}$ inch, place a scratch course at the joint or mill/grind joints to reduce faulting. Do not allow the surface temperature of the pavement to exceed 120F before the overlay placement. Control the asphalt surface temperature by misting the surface, using a white-pigmented curing compound, whitewashing with lime water, or other method approved by the Department Representative.

Class AA Cement Concrete Slip-Form Paving

A final cement concrete overlay is placed. Attention must be given to the placement of dowel baskets, location of expansion joints, saw cut depths, joint spacing, sawing for creating concrete overlay joints, longitudinal joints, and concrete curing. A PAMS (poly-alpha-methyl styrene) liquid membrane curing compound is required.

Measuring & Payment Methods

Bonded & Thin Bonded Overlays of Asphalt-Surfaced Pavements & Bonded Concrete Overlays of Concrete Pavement Surfaces

Profile milling and surface preparation, along with bonded and thin bonded concrete overlays of asphalt surfaces and bonded concrete overlays of concrete pavement surfaces, are paid for by the square yard. Instances where there is additional concrete used beyond what is needed for the overlay section at the specified depth, not to exceed 2 percent of the calculated overlay quantity, may be paid as cement concrete Class AA by the cubic yard.

Concrete overlay transitions and concrete pavement cores are paid on an each unit basis.

Unbonded Concrete Overlay of Concrete Pavement Surfaces

The overlay itself will be paid as cement concrete class AA on a cubic yard basis.

The geotextile separation layer is paid for by the square yard.

The asphalt separation layer is paid by the tons of asphalt placed.

Concrete overlay transitions are paid on an each unit basis.

10. CONCRETE PAVEMENT JOINT & SPALL REPAIR (SEC. 519 & 525)

This section addresses the construction of full-depth longitudinal repair of existing concrete pavement and partial-depth cement concrete spall repair on existing concrete pavements, including joint and surface spalls.

Full-Depth Longitudinal Concrete Joint Repair

This work is the full-depth longitudinal repair of existing concrete pavement in accordance with PUB 408 Section 519. If diamond grinding is to be performed, test the pavement surface in the longitudinal direction, as specified in PUB 408 Section 514.3.

Partial-Depth Concrete Pavement Repair

This work is the construction of a partial-depth repair of an existing concrete pavement in accordance with PUB 408 Section 525. This type of repair is suitable for use on transverse or longitudinal joints, cracks, and interior slab spalls if the depth of the repair is no greater than half the slab thickness. Areas greater than half the depth of the slab are repaired as specified in PUB 408 Section 516. Partial-depth concrete pavement repair is classified into two types based on spall length as follows:

- 1) **Type 1:** Spot repairs of transverse or longitudinal joints, cracks, and interior slab surface spalling between 15 inches and 6 feet in length.
- 2) **Type 2:** Extended-length repairs of transverse or longitudinal joints, cracks, and interior slab surface spalling in lengths greater than 6 feet.

☐ Review

 Documentation Required

BEFORE CONCRETE PAVEMENT JOINT & SPALL REPAIR CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure repair areas are marked out in advance by the Department Representative.	

DURING CONCRETE PAVEMENT JOINT & SPALL REPAIR CHECKLIST

☐		Task	Reference
Full-depth Longitudinal Concrete Joint Repair			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		If constructing full or partial depth patching adjacent to longitudinal joint repairs, ensure all patches are constructed prior to performing longitudinal repairs.	
☐		For any full-depth repair adjacent to the longitudinal joint, verify the patch is combined with the longitudinal repair along that portion of the joint repair.	
☐		After saw cutting the existing pavement, ensure traffic is only allowed on repair areas of existing pavement for a maximum of 72 hours.	
☐		Verify saw cuts greater than ½ inch in width are not opened to traffic.	
☐		Confirm excavated repair areas do not remain unpatched for more than 48 hours or over weekends or holidays.	
☐		Ensure traffic is protected from drop-off conditions as specified in PUB 408 Section 901.3.	
☐		Verify a saw equipped with a diamond-tipped blade, a blade guard, alignment guides, a water-cooling system, and cut-depth controls are provided for saw cutting the perimeter of the patch.	
☐		Confirm cooling water, slurry, and dust from the sawing operation are not allowed to enter any lane opened to traffic.	
☐		Ensure all required full-depth longitudinal saw cuts are made along the perimeter of the repair prior to making any full-depth transverse saw cuts.	
☐		Verify break back of the underside of the existing pavement does not occur.	
☐		If break back or spalling occurs, ensure a new full-depth transverse saw cut beyond the area of break back or spalling is performed, and that the additional length of repair is performed at no additional cost to the Department.	

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☐		Task	Reference
☐		Ensure full-depth saw cuts at the repair limits only extend transversely into the adjacent pavement up to full-depth plus 2 inches and the dowel bars in the adjacent lane are not damaged.	
☐		Verify additional transverse saw cuts between the patch limits do not extend transversely into the adjacent lane.	
☐		Confirm concrete removed between narrowly spaced saw cuts at the end of a proposed repair area is done in a manner that does not damage any adjacent pavement that is to remain in place.	
☐		Ensure concrete removal is performed in a way that minimizes disturbance to the existing subbase and damage to the adjacent pavement to remain in place.	
☐		If the surface of the subbase is disturbed by the removal technique, verify the area is recompactd using small vibratory compactors.	
☐		If the disturbed material is deeper than 1 inch, confirm this material is removed with hand tools and replaced with concrete during paving at no additional cost to the Department.	
☐		Ensure all subbase surface irregularities are corrected exceeding 1 inch in depth by loosening the surface and removing or adding material, as required, and compacting to the proper grades and slopes.	
☐		Verify unsuitable subbase material is removed and replaced as specified in PUB 408 Section 350.3.	
☐		Confirm repairs are completed as shown on PUB 72M RC Standard 26M and as specified in PUB 408 Section 501.3.	
☐		Ensure the surface of the patch is finished and textured to match the existing pavement cross section.	
☐		Verify all longitudinal and transverse joints constructed as part of this work, and all saw cuts extending beyond the patch limits are sealed, as specified in PUB 408 Section 501.3.	
Partial-depth Concrete Pavement Repair			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	

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☐		Task	Reference
☐		Ensure pavement around spalls is sounded with a light hammer steel bar or chain drag in the presence of the Department Representative to detect delaminated areas.	
☐		Verify the area to be replaced is marked approximately 3 inches beyond the delaminated areas.	
☐		Confirm all repair areas are rectangular, with minimum dimensions of 15 inches in length by 10 inches in width by 2 inches in depth.	
☐		Ensure all repairs are marked out square.	
☐		Verify spall repair areas are a minimum of 24 inches apart. If closer than this minimum, ensure the repair areas are combined.	
☐		Confirm all unsound concrete in the designated repair area is a minimum depth of 2 inches and a maximum depth of half of the slab thickness.	
☐		For Type 1 partial-depth repairs only, ensure the perimeter of the repair area is saw cut and concrete is removed to a minimum depth of 2 inches.	
☐		Verify concrete is removed using chipping hammers 35 pounds or less and at a 30 to 60-degree angle.	
☐		Confirm the contractor does not disturb the concrete outside the limits of the repair area.	
☐		Unless concrete is continuously reinforced, ensure any exposed rebar in the repair area is cut and removed from jointed reinforced concrete pavement.	
☐		After removal, verify the repair area is resounded to ensure that all delaminated concrete was removed.	
☐		If dowel bars in the transverse joint are exposed and show little sign of corrosion or other damage, confirm a bond-breaking material is applied to all exposed surfaces of these bars.	
☐		Ensure the area is sandblasted or water blasted within 24 hours of concrete placement and final cleaning is done with a 100-psi air blaster within 30 minutes of concrete placement.	
☐		Verify mixing equipment for volumetrically mixed concrete is furnished as specified in PUB 408 Section 704.3 or verify hand-batched mixtures are produced using a power-driven revolving and	

Section 500: Rigid Pavement

☐		Task	Reference
		tilting drum mixer or suitable revolving paddle mixer capable of thoroughly mixing the repair material.	
☐		If the partial-depth repair abuts an existing transverse joint, confirm that ½-inch expansion joint material is installed in the joint.	
☐		If the partial-depth repair abuts an existing longitudinal joint, confirm that ¼ inch preformed cellular polystyrene is installed in the joint.	
☐		Ensure the expansion joint material and the preformed cellular polystyrene extend at least ½ inch below the bottom of the repair whenever possible.	
☐		Verify longitudinal joints are sealed as specified in PUB 408 Section 512.3 and transverse joints are sealed as specified in PUB 408 Section 521.3.	
☐		Immediately after final cleaning, ensure grout or epoxy bonding compound is applied to all exposed surfaces within the repair area.	
☐		Verify the grout is mechanically mixed and applied by brushing or scrubbing in a thin layer onto the concrete surface.	
☐		Confirm the epoxy bonding compound is prepared and applied according to the manufacturer's recommendations, not allowing the grout or epoxy bonding compound to run or puddle in low spots.	
☐		Ensure concrete is placed in the repair area before the grout begins to dry or while the epoxy bonding compound is still tacky.	
☐		Verify that dried grout or hardened epoxy bonding compound is removed, the area is recleaned as specified in PUB 408 Section 525.3, and the repair area is recoated with fresh grout or epoxy bonding compound prior to placing concrete.	
☐		Confirm ambient air and surface temperatures are 40F and rising prior to placing concrete. Discontinue placement of the mixture if the ambient air and surface temperatures fall below 40F.	
☐		Ensure repairs are protected from freezing for a minimum of 24 hours.	
☐		Verify the concrete is consolidated using a spud vibrator.	
☐		Confirm concrete is worked into saw cuts extending beyond the corners of the repair area, and concrete is struck off to match the surrounding pavement, including wheel ruts.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Ensure expansion joint material and preformed cellular polystyrene are used as temporary forms that extend to the pavement surface to keep the concrete out of existing joints.	
Rapid Set Concrete Patching Material			
☐		Ensure the mixed material is placed only within the manufacturer's recommended installation temperature range and when the ambient air and surface temperatures are 40F or greater. Discontinue placement of the mixture when the ambient air and surface temperatures are outside of the manufacturer's recommended installation range or lower than 40F.	
☐		Verify the rapid set concrete material is consolidated using a vibrator or tamper.	
Curing & Opening to Traffic			
☐		Ensure repairs are protected from freezing for a minimum of 24 hours.	
☐		Ensure Class AA modified and accelerated concrete is cured using white membrane forming curing compound as specified in PUB 408 Section 516.3.	
☐		Verify insulation or heating of repair areas is provided for Class AA accelerated concrete if the ambient air temperature drops below 80F during the curing operation.	
☐		Confirm all completed repair areas are resounded in the presence of the Department Representative, and any completed repair areas that are delaminated are replaced at no cost to the Department.	
☐		Ensure that the patch area is opened to traffic for Class AA concrete based on the repair thickness according to Table D in PUB 408 Section 501.3.	
☐		Verify that the patch area is opened to traffic for Class AA accelerated concrete based on the repair thickness according to Table D in PUB 408 Section 501.3.	
☐		Confirm that the patch area is opened to traffic for rapid set concrete to traffic according to PUB 408 Section 516.3.	

AFTER CONCRETE PAVEMENT JOINT & SPALL REPAIR CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document all concrete testing performed is recorded in the concrete app, all concrete placed, batch mixer slips, and concrete delivery tickets were received.	eConcrete

Material & Equipment

The materials used for the work include Class AA cement concrete (modified or special), rapid set concrete patching material, and concrete curing materials. The contractor may also use an air entrainment admixture, epoxy bonding compound, preformed cellular polystyrene, joint sealant, expansion joint filler, tape bond breaker, and grout. All materials must come from an approved supplier.

Equipment includes a concrete saw, pneumatic air chipping hammers, a sand blaster or a water blaster, and an air compressor capable of 100 psi. The contractor must also have the equipment to test the concrete.

Mechanical:				
Abrasive Blasting Machine	Air Compressor	Concrete Mixer Truck	Concrete Saw	Jackhammer
Pneumatic Air Chipping Hammer	Sand Blaster	Skid Steer	Tar Buggy	Tri-Axle Dump Truck
Water Blaster				
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Crack Filler Applicator	Screed	Shovel	Trowel	
Testing/Inspection:				
Bond Strength Testing Equipment	Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level

Construction Methods

The contractor, under the supervision of a Department Representative, tests the area with a light hammer or chain drag to define the limits of delineation. Spall areas are prepared per PUB 408 Sections 519 and 525.

Loose concrete is removed, and the area is scarified as required.

After cleaning and sandblasting the area as required, the contractor applies the grout and epoxy bonding compound. The contractor's certified technician tests the concrete, and then the concrete is placed. Curing is applied as required.

Measuring & Payment Methods

Spall repair, regardless of type, is paid for by the square yard.

Joint sealing is paid for by the linear foot.

11. RUBBLIZING OF CONCRETE PAVEMENTS (SEC. 526)

This work is rubblizing and seating existing concrete pavements before the placement of a pavement overlay in accordance with PUB 408 Section 526. Rubblizing is classified into two types:

- 1) **Type 1:** Rubblizing pavement into pieces with a maximum horizontal dimension of 12 inches.
- 2) **Type 2:** Rubblizing pavement into pieces with a maximum horizontal dimension of 8 inches and at least 50 percent of the pieces in each square yard having a maximum horizontal dimension of 4 inches.

☐ Review  Documentation Required

BEFORE RUBBLIZING OF CONCRETE PAVEMENTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review applicable training videos.	Construction Training Videos
☐	Ensure overlaying asphalt material is removed before the rubblizing process begins.	

DURING RUBBLIZING OF CONCRETE PAVEMENTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the contractor follows the approved rubblizing plan.	MCDocs
☐	Verify the contractor uses mechanical or sonic equipment capable of rubblizing concrete through full depth.	
☐	For Type 2 rubblizing, confirm pieces are free of their bond with reinforcement to ensure proper seating.	
☐	Ensure two full-depth 3-foot by 12-foot sections of rubblized pavement are excavated within the first ½ mile of the operation to ensure the pavement is being rubblized to the specific dimensions. Ensure this is repeated whenever some aspect of the operation	

Section 500: Rigid Pavement

☐		Task	Reference
		changes and that excavated areas are filled with coarse aggregate in a maximum of 6-inch lifts.	
☐		Ensure the contractor cuts off and removes any exposed rebar at the surface.	
☐		Verify any steel plates in the concrete joints are removed.	
☐		Confirm care is used to prevent shattering the pavement edges adjacent to asphalt base repairs.	
☐		Ensure extreme care is used to prevent damage to underground utilities, drainage, approach slabs, and bridge decks. Repairs to these areas are made at no cost to the Department.	
☐		Verify the contractor uses a pneumatic-tired roller (not a vibratory roller) to seat the rubblized pavement and that all areas are rolled.	
☐		Confirm that the roller's vertical deflection is less than $\frac{3}{4}$ inch to ensure the final seating is satisfactory.	
☐		Ensure unsatisfactory areas are undercut, and verify any unsuitable material is removed.	
☐		Verify the overlay is completed within 60 days of final seating.	
☐		Confirm that rubblized pavement is not exposed to freezing conditions.	
☐		Collect truck delivery tickets for materials.	eTicketing

AFTER RUBBLIZING OF CONCRETE PAVEMENTS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the surface is clean and swept after final seating.	
☐		Ensure that traffic is prohibited on the roadway after this operation.	

Material & Equipment

Material for the work includes coarse aggregate or 2A subbase to fill excavations. This material must be from an approved supplier.

Section 500: Rigid Pavement

Equipment for the work includes mechanical or sonic rubblizing equipment and a pneumatic-tired roller.

Mechanical:				
Concrete Rubblization Machine	Excavator	Pneumatic Tire Roller	Tri-Axle Dump Truck	
Hand Tools:				
Shovel				
Testing/Inspection:				
Measuring Wheel				

Construction Methods

The contractor removes the asphalt pavement overlaying the concrete that is to be rubblized. This concrete is then rubblized using mechanical or sonic equipment capable of providing concrete pieces of the specified dimensions. Depending on the type of rubblizing, ensure that concrete pieces are free of bonds with reinforcement.

Use coarse aggregate to backfill all excavated areas. Place the backfill in maximum 6-inch lifts and compact by rolling until nonmovement is achieved.

The contractor seats the rubblized pavement with a 50-ton pneumatic-tired roller to seat the rubblized pavement. Do not use vibratory rollers. The surface is then cleaned, and loose material is removed.

Measuring & Payment Methods

Rubblizing and seat concrete pavement are paid for by the square yard.

Payment for Class 1A excavation, Class 1B excavation, and coarse aggregate is based on cubic yards.

12. DOWEL RETROFIT & CONCRETE PAVEMENT CROSS-STITCHING (SEC. 527 & 528)

This section addresses the installation of epoxy-coated, smooth dowel bars into existing concrete pavement across cracks or transverse joints without dowels in accordance with PUB 408 Section 527

This section also includes cross-stitching longitudinal cracks and may include cross-stitching longitudinal joints in plain cement concrete pavement by placing epoxy-coated deformed tie bars at an angle across the longitudinal joint or crack in accordance with PUB 408 Section 528.

☐ Review  Documentation Required

BEFORE DOWEL RETROFIT & CROSS-STITCHING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure a demonstration of the cross-stitching operation is performed and receive final approval of operation procedures and an assessment of the capability of the equipment to be used.	

DURING DOWEL RETROFIT & CROSS-STITCHING CHECKLIST

☐ 	Task	Reference
Dowel Retrofit		
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure a power-driven, self-propelled saw capable of making two parallel cuts per dowel bar slot is used.	
☐	Verify pavement is saw cut to place center of dowel at mid-depth of pavement slab per PUB 72M RC Standard 26M. If the repair area spans different pavement thicknesses (e.g., mainline to ramp transitions), place it at the mid-depth of the thinner slab.	
☐	Confirm saw cuts are aligned parallel to the roadway centerline.	
☐	Ensure three dowel slots are created (six saw cuts) per wheel path and centered over the crack or transverse joint per PUB 72M RC Standard 26M.	

Section 500: Rigid Pavement

☐		Task	Reference
☐		Verify a jackhammer weighing not more than 30 pounds is used to remove concrete between saw cuts.	
☐		Confirm a level surface is created at the bottom of the slot parallel to the roadway surface.	
☐		Ensure all exposed surfaces of slots are cleaned, and all loose and foreign material is removed within 24 hours before concrete placement, removing all slurry to prevent debris from emerging once dried.	
☐		Verify final cleaning is completed within 30 minutes before concrete placement, ensuring areas are re-cleaned if not repaired within 30 minutes of final cleaning or if contamination occurs before concrete placement.	
☐		When cleaning by air blasting, verify a compressed air stream of at least 100 pounds per square inch measured at the source, free of oil, moisture, and other contaminants, is used.	
☐		Ensure ¼ inch thick preformed cellular polystyrene material is cut to the cross section dimensions of the slot at the joint, and an opening is cut in the polystyrene joint material to allow the dowel to fit without stretching and without gaps.	
☐		Verify the material is centered on the dowel to form a temporary joint and bond-breaker lubricant is applied to Type B coated dowel bars unless a bond-breaker lubricant has been applied in the shop.	
☐		Ensure brushes are not used to apply lubricant.	
☐		Verify the lubricant is applied at least 1 hour before placing the concrete around the dowel assembly.	
☐		Confirm 1 ½-inch non-metallic expansion caps with 1/4-inch clearance from the end of the dowel to the bottom of the cap are used for Type A dowels per PUB 72M RC Standard 26M.	
☐		For crack or joint widths greater than ¼ inch, ensure expansion joint material is used instead of the preformed cellular polystyrene material with a thickness matching the crack or joint width.	
☐		Verify plastic or non-metallic chairs with a minimum ½ inch clearance between the dowel bar cap and all slot surfaces, including the end, both sides and bottom, are used.	

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☐		Task	Reference
☐		Ensure coated dowel bars are placed parallel to the roadway centerline and pavement surface, not to exceed the limits indicated in PUB 408 Section 527.3.	
☐		Verify the temporary joint material is sealed at the sides and bottom of the transverse joint or crack with a caulking compound to prevent concrete patching material from entering the existing joint or crack.	
☐		Confirm epoxy bonding is applied to all properly prepared surfaces according to the manufacturer's specifications.	
☐		Ensure the slot is filled with approved concrete patching material and is vibrated to thoroughly consolidate the material in the slot and around the dowel bar.	
☐		Verify the dowel bars do not move during material placement.	
☐		Confirm the surface of the slots is finished to match the existing pavement surface profile, including any existing wheel ruts.	
☐		Ensure concrete is cured according to PUB 408 Section 516.3.	
☐		Verify transverse contraction joints are sawn and sealed for the entire lane width as required.	
☐		Confirm the patch area is opened to traffic according to PUB 408 Section 516.3.	
Concrete Pavement Cross-Stitching			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure work is not performed if the ambient air or surface temperature is below 40F.	
☐		Verify that drifted slabs are not moved back into position against the adjacent slabs.	
☐		Confirm cross-stitching is not used on transverse joints or cracks.	
☐		Ensure longitudinal joints are saw cut the entire length of the slab before beginning cross-stitching operations.	
☐		Verify a hydraulic-powered drill that minimizes damage to the concrete surface is used, and a drill rig is used to ensure that the proper drill angle is maintained; the use of a gang-mounted drill is allowed.	

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☐		Task	Reference
☐		Confirm holes no more than 3/8 inch larger in diameter than the tie bar are drilled on each side of the longitudinal joint or longitudinal crack at the required angle, offset distance, and spacing as shown on PUB 72M RC Standard 26M.	
☐		Ensure the drilled holes are thoroughly cleaned of all dust and debris. If using compressed air, use a stream measuring at least 100 pounds per square inch at the source, free of oil, moisture, and other contaminants.	
☐		When installing tie bars, verify epoxy bonding compound is injected into the hole using a caulking gun or other approved method, leaving adequate space for the bar.	
☐		Confirm the tie bar is rotated three to five complete rotations while inserting the tie bar to purge air voids as completely as possible.	
☐		Ensure 1-inch coverage is provided for the tie bar at the surface of the pavement and the epoxy bonding compound is troweled flush with the pavement surface.	
☐		Verify the longitudinal crack or longitudinal joint is routed to a width of 3/4 inch wide and a depth of 1 inch. Immediately after routing, ensure the entire longitudinal crack or longitudinal joint is flushed with water.	
☐		Immediately before placing the sealant, confirm the longitudinal crack or longitudinal joint is cleaned and dried.	
☐		Ensure the ambient air and pavement surface temperature are above 40F before placing a joint sealant.	
☐		Verify the longitudinal crack or joint is filled to a level of 1/8 inch to 1/4 inch below the pavement surface.	
☐		Ensure the roadway is not open to traffic until the anchoring material has fully cured following the manufacturer's recommendations.	

AFTER DOWEL RETROFIT & CROSS-STITCHING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Material for the work includes load transfer units, caulking compound, preformed cellular polystyrene, rapid set concrete patching material, curing materials, intermediate curing compound, concrete admixtures, joint sealing material, bond breaker lubricant, expansion joint filler, reinforcement bars, and epoxy bonding compound. This material must be procured from an approved supplier.

Equipment includes a concrete saw, air chipping hammers, concrete drill, sand blaster or a water blaster, and an air blaster capable of 100 psi. The contractor must also have equipment to test the concrete.

Mechanical:				
Air Blaster	Air Compressor	Concrete Drill	Concrete Mixer Truck	Concrete Saw
Jackhammer	Pneumatic Air Chipping Hammer	Sand Blaster	Skid Steer	Tar Buggy
Tri-Axle Dump Truck	Water Blaster			
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Crack Filler Applicator	Screed	Shovel	Trowel	
Testing/Inspection:				
Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level	

Construction Methods

Dowel Retrofit

The contractor will lay out the bar locations in the wheel paths and saw cut parallel at the bar locations half the depth of the slab. The concrete is removed using chipping guns to form a slot with a flat, level bottom. The slot is thoroughly cleaned of all debris with 100 psi minimum compressed air, and Polystyrene is placed on the bar to fill the joint and set on plastic or galvanized chairs. Rapid set concrete patching material is mixed and placed into the slot, vibrated, and finished to match the existing pavement cross section and texture, including wheel ruts.

Concrete Pavement Cross-Stitching

The concrete slabs getting repaired are first sawn full-depth longitudinally and thoroughly cleaned. Holes are drilled through both slabs at the depth and angle specified in the standard drawings, then thoroughly cleaned of all debris and slurry. The hole is injected with an approved epoxy

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bonding compound, and the tie bar is inserted into the hole while being rotated and set 1 inch below the pavement surface. Epoxy is then troweled flush with the pavement surface.

Measuring & Payment Methods

The dowel retrofit is paid by each for the existing joint or crack preparation and includes six dowel bars per joint or crack.

The cross-stitching is paid by each tie bar at each individual location.

REFERENCES

AASHTO T119 Standard Method of Test for Slump of Hydraulic Cement Concrete

AASHTO T152 Air Content by the Pressure Method

AASHTO T196 Air Content of Concrete (Volumetric Method)

AASHTO T277 Standard Method of Test for Rapid Determination of the Chloride Permeability of Concrete

Approved Asphalt Mix Designs Source of Supply – [ECMS](#)

Approved Comprehensive Quality Control Plan – [PPCC](#)

Approved Concrete Quality Control Plan – [PPCC](#)

Approved Field Operation Quality Control Plan – [PPCC](#)

Approved Quality Control Plan – [PPCC](#)

ASTM C-1583 Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)

[Lightweight Profiler](#) Certification List

[PUB 19](#) Field and Laboratory Testing Manual

- PTM 1 (Probability Sampling)
- PTM 428 (Measuring Pavement Profile Using a Light Weight Profiler)
- PTM 604 (Comprehensive Strength of Molded Concrete Cylinder)
- PTM 606 (Obtaining and Testing Drilled Cores of Concrete)
- PTM 614 (Measuring the Length of Drilled Concrete Cores)
- PTM 640 (Estimating Concrete Compressive Strength by the Maturity Method)
- PTM 643 (Concrete Pavement Joint Reservoir Wipe Test)

[PUB 35](#) Qualified Products List for Construction (Bulletin 15)

[PUB 72M](#) Roadway Construction Standards

- RC Standard 11M (Classification of Earthwork for Structures)
- RC Standard 20M (Concrete Pavement Joints)
- RC Standard 21M (Reinforced Concrete Pavement)
- RC Standard 23M (Bridge Approach Slabs)
- RC Standard 24M (Pavement Relief Joint)
- RC Standard 26M (Concrete Pavement Rehabilitation)
- RC Standard 27M (Plain Concrete Pavement)
- RC Standard 28M (Overlay Transitions and Paving Notches)

[PUB 213](#) Temporary Traffic Control Guidelines

[PUB 408](#) Highway Construction Specifications

- Section 206 (Placement and Compaction of Embankment and Fill)
- Section 212 (Geotextiles)
- Section 313 (Superpave Asphalt Mixture Design, Standard Construction, Base Course)
- Section 350 (Subbase)

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- Section 405 (Evaluation of Asphalt Pavement Longitudinal Joint Density and Payment of Incentive/Disincentive)
- Section 410 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed HMA Fine-Graded Courses)
- Section 413 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed Asphalt Courses with Percent within Limits and LTS Testing (PWL-LTS))
- Section 492 (Profile Milling of Asphalt Pavement Surfaces)
- Section 501 (Reinforced or Plain Cement Concrete Pavements)
- Section 504 (Pavement Relief Joint)
- Section 505 (Bridge Approach Slabs)
- Section 506 (Reinforced or Plain Cement Concrete Pavements, RPS)
- Section 507 (Evaluation of Concrete Pavement Ride Quality and Payment of Incentive)
- Section 509 (Next Generation Concrete Surface)
- Section 510 (Longitudinal Grooving of Existing Concrete Pavement)
- Section 511 (Pressure Relief Joint)
- Section 512 (Longitudinal Joint Cleaning and Sealing)
- Section 513 (Joint Rehabilitation)
- Section 514 (Diamond Grinding of Concrete Pavement)
- Section 515 (Sawing and Sealing of Asphalt Overlays)
- Section 516 (Concrete Pavement Patching)
- Section 517 (Transverse Grooving of Concrete Pavement for Retexturing)
- Section 518 (Continuously Reinforced Concrete Pavement for Retexturing)
- Section 519 (Full Depth Longitudinal Concrete Joint Repair)
- Section 521 (Transverse Joint Cleaning and Sealing)
- Section 525 (Concrete Pavement Partial-Depth Repair)
- Section 526 (Rubblizing of Concrete Pavements)
- Section 527 (Dowel Retrofit)
- Section 528 (Concrete Pavement Cross-Stitching)
- Section 540 (Bonded Concrete Overlay of Asphalt-Surfaced Pavement)
- Section 541 (Thin Bonded Concrete Overlay of Asphalt-Surfaced Pavement)
- Section 545 (Bonded Concrete Overlay of Concrete-Surfaced Pavements)
- Section 548 (Unbonded Concrete Overlay of Concrete-Surfaced Pavements)
- Section 590 (Crack Cleaning and Sealing)
- Section 591 (Milling of Cement Concrete Pavement Surface)
- Section 704 (Cement Concrete)
- Section 705 (Joint Material)
- Section 708 (Fiber)
- Section 901 (Maintenance and Protection of Traffic During Construction)
- Section 1001 (Cement Concrete Structures)
- Section 1002 (Reinforcement Bars)

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SECTION 600: INCIDENTAL CONSTRUCTION

GOALS

- Ensure the BEST possible riding surface is obtained for the motoring public.
- Ensure QUALITY construction work is being performed, documented, and within compliance with specific designs, provisions, specifications, and applicable publications.

INCIDENTAL CONSTRUCTION SAFETY

- **Traffic Control:** Properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** Construction activities have many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Access:** Verify that the contractor has provided adequate means of accessing the area where they are working. These means could include a ladder, a temporary staircase, or a walkway. If the means of access seem unsafe, do not enter the area, and contact your supervisor immediately.
- **Working in an Excavated Area or Trench:** Ensure the excavated area is safe to work in by cutting back the slopes, installing a trench box, or shoring, as contractors are required by OSHA to implement the necessary measures to do so. If these areas do not appear safe, contact your supervisor immediately, and do not enter the excavated area.
- **Drill Rig Safety Awareness:** During drilling operations, keep yourself and others clear of the drill rig as drilling operations are occurring, including raising and lowering the drill tools. Do not stand in the excavation during drilling.

1. CONSTRUCTION SURVEYING (SEC. 686)

This section addresses construction surveying for roadways, roadway appurtenance, and structures. The work involves preserving vertical and horizontal controls and stationing throughout the construction phase, up to and including the final inspection, and providing the Department inspection force with surveying control points to ensure the quality of construction activities.

☐ Review  Documentation Required

BEFORE CONSTRUCTION SURVEYING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review the location of the existing monuments, which should be included in the contract drawings.	MCDocs
☐ 	Verify the type of surveying performed and what is being surveyed.	MCDocs

DURING CONSTRUCTION SURVEYING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that a Professional Land Surveyor (PLS) or Professional Engineer (PE) performs survey work.	MCDocs
☐ 	Verify the contractor performs the required surveying for the type indicated, as outlined in PUB 408 Section 686.	
☐ 	Verify new benchmark disks are placed as directed.	MCDocs
☐ 	Monitor survey stakes and inform the Inspector-in-Charge (IIC) if any have been damaged or moved.	MCDocs

AFTER CONSTRUCTION SURVEYING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 600: Incidental Construction

☐		Task	Reference
☐		Ensure benchmarks and markers are not damaged or destroyed by the contractor. If a monument must be removed, first notify the Department. Replacement monuments can be picked up from the District storage room. The contractor should check the location of the new monuments, and the information needs to be sent to the Department Representative.	

Material & Equipment

The contractor needs surveying instruments, such as an electronic distance measurement (EDM), survey transit, or level, capable of performing the survey work for the type indicated.

The contractor may elect to use a global position system (GPS) survey. GPS is a satellite-based positioning and navigation system owned and operated by the United States Department of Defense and is used in numerous private and public applications. The system is accessible 24 hours a day, 365 days a year. GPS incorporates NavStar, a constellation of orbiting satellites that provides continuous real-time data, including accurate location information (latitude, longitude, and altitude), precise tie, and passive all-weather information, to surveyors throughout the world.

However, even with GPS surveys, errors can occur. Surveyors often draw data from multiple satellites to minimize errors and determine an average reading. When surveying with GPS, rather than measuring the absolute positions of the points, the baseline between two points is computed instead.

If the contractor elects to use Automated Machine Guidance (AMG), they must include the equipment type, control software manufacturer and version, grading plans, quality process, tolerance requirements, and the proposed location of the local global navigation satellite system (GNSS) base station used for broadcasting differential correction data to rover units to the Department in the AMG Quality Control (QC) plan as specified in PUB 408 Section 106.3.

Hand Tools:				
Electronic Distance Measurement				
Testing/Inspection:				
4-foot Smart Level	Survey Transit			

Surveying Methods

The contractor performs the construction surveying as outlined in PUB 408 Section 686 to control the project.

Measuring & Payment Methods

Construction surveying is paid by lump sum. The payments are made as a percentage of the lump sum, based on the percentage of the total contract amount completed, which is outlined in PUB 408 Section 686.

2. PIPE CULVERTS (SEC. 601, 602, 603, & 604)

This section addresses the construction or reconstruction of pipe culverts, the construction or reconstruction of corrugated metal pipe-arch culverts, the construction of metal plate pipes, metal plate pipe-arches, metal plate arch culverts, and the construction of a combination storm sewer and underdrain.

☐ Review

 Documentation Required

BEFORE PIPE CULVERT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch applicable pipe installation and inspection training videos.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if cast-in-place (CIP) concrete pour is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.05.	
☐ 	Review the contractor's approved pipe lifting plan.	PPCC
☐ 	Ensure pre-cast units are checked on arrival to ensure that the fabricator has stamped them and that they are stamped with the proper information.	MCDocs
☐ 	Ensure pre-cast units are checked for damage, such as cracks and spalls, upon arrival.	MCDocs

DURING PIPE CULVERT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the contractor controls the alignment and grade of the pipe by an acceptable method.	

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☐		Task	Reference
☐		Ensure the pipe trench is excavated and backfilled for the type of pipe placed, per PUB 72M RC Standard 30M, and that OSHA standards are followed.	
☐		Check that the bedding material and backfill material are placed in a manner that meets the requirements of PUB 72M RC Standard 30M for the type of pipe used.	
☐		Verify the contractor has an acceptable method for controlling water that may flow through or gather in the pipe trench.	
☐		Confirm corrugated metal pipe joints are connected properly with metal bands and bolts provided by the manufacturer.	PPCC
☐		Verify pipe connectors and collars are sealed and cured as outlined in PUB 408 Section 601.	
☐		Ensure the pipe is not damaged during installation and that the contractor is following the approved lifting plan. Complete Form CS-6 .	
☐		Accept pipe trench backfill compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Complete Forms TR-4276B or TR-478A and attach them to the Project Site Activity (PSA).	

AFTER PIPE CULVERT CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Witness the contractor perform their final inspection of these pipes as specified in PUB 408 Section 601.3 and obtain the appropriate inspection reports and documentation from the contractor according to PUB 19 PTM 450, review the information provided to determine specification compliance and complete those portions of Form CS-601 that were not able to be completed at the time of the inspection. Refer to PUB 2 Part C.6.5 for additional information and required procedures.	
☐		Perform a Department inspection as specified in PUB 408 Section 601.3 for non-100-year design life pipes and complete Form CS-601 . Refer to PUB 2 Part C.6.5 for additional information and required procedures.	

Material & Equipment

The material and equipment used must conform to the requirements specified for pipe culverts and meet the requirements of PUB 408 Section 601 and RC Standard 30M. Adjustments can be made with pre-cast extensions.

The contractor must submit shop drawings showing all physical properties of the plates and joint design for approval. The pipe should be thoroughly checked (inside and outside) for visible damage, including cracks, chips, and spalls. In addition to the pipe, the contractor must use (AASHTO) No. 8 coarse aggregate for pipe trench bedding and No. 2A coarse aggregate or No.57 coarse aggregate for pipe trench backfill. If No.57 coarse aggregate is used for backfill, approved Class 1 geotextile must be used for encasement. All materials used must be from suppliers listed on the contractor's approved material source of supply.

The contractor needs an excavator, such as a backhoe, excavator, trencher, or gradall, to excavate the pipe trench, and a vibratory plate compactor to compact the bottom of the trench and compact the trench backfill. The contractor needs a front loader or excavator to place the trench bedding and backfill. A dump truck is necessary to haul excess excavated material from the pipe trench to an approved waste area.

A survey transit is required to lay out the location of and to set elevations for the placement. The contractor needs a level and string line or an electronic laser system to control the alignment and grade of the pipe trench excavation and pipe placement, as well as a nuclear gauge to check the density of the trench backfill after compaction. The contractor may also need a shore box for the excavation, depending on the depth of the trench and the type of material the trench is in (as outlined in OSHA Standards).

Mechanical:				
Backhoe	Dump Truck	Excavator	Gradall	Front End Loader
Trench Roller	Trencher	Vibratory Plate Compactor		
Hand Tools:				
Laser Level				
Testing/Inspection:				
4-foot Smart Level	Engineer Ruler	Nuclear Gauge	Survey Transit	Tape Measure

Construction Methods

The contractor lays out the pipe run, and a level and string line or an electronic laser system is set up to control the alignment and grade of the excavation. The contractor then excavates the pipe trench to the dimensions shown on PUB 72M RC Standard 30M for the type and size of pipe being placed and, if required by OSHA standards, places a shore/trench box in the trench. The "bell" end of the pipe is always upstream of the flow. To properly tie the pipe into the inlet box, the bell end must be cut off. After the pipe is tied into the inlet box, the void around the pipe and box

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is sealed with mortar inside and outside. Occasionally, the void is too large for grout; in these situations, the void is sealed with bricks and mortar.

The bricks are then parged to reinforce the seal. The construction of metal plate pipes, metal plate pipe arches, and metal plate arch culverts is performed as outlined in PUB 408 Section 603. Bedding and backfill material are placed according to PUB 72M RC Standard 30M for the type of pipe being placed.

Measuring & Payment Methods

Pipe culverts, re-laid pipe culverts, metal plate culverts, corrugated metal pipe-arch culverts, and combination storm sewer and underdrain are paid by the linear foot for the total length of pipe placed. If the pipe runs from inlet to inlet, the pipe is measured from the inside face of the inlet box to the inside face of the inlet box. If the pipe does not connect to an inlet on both ends, the pipe is measured to the end as it protrudes from a slope or to its connection to an outlet item, such as an end wall. The pipe item includes the excavation, the removal and disposal of existing pipe, the bedding material, the pipe, connecting bands, and the backfill as shown on the standard drawings or as indicated in the plans.

If a shore/trench box is indicated or required, the placement, removal, and keeping of the shoring in place, supports, and shield systems for the trench box are all incidental to the pipe culvert. For combination storm sewer and underdrain, the geotextile and placement of the geotextile are also incidental to the item of work.

Cleaning of existing pipes, if required, is paid for by the linear foot. All linear foot items are field-measured. Computations for cubic yards must be shown on a PSA. The PSA software includes a pipe payment computation program.

3. END WALLS, INLET BOXES, UTILITY HOLES, & SPRING BOXES (SEC. 605)

This section addresses the construction of end walls, inlets, utility holes, and spring boxes.

Inlets

An inlet collects water from the roadway and conveys it to the underground storm drain system.

End Walls

End walls are integrated walls located at either end of a drainage pipe or a stream crossing structure. A wall built at a pipe inlet is a headwall. A wall built at a pipe outlet is an end wall.

Utility Holes

Utility holes are a covered opening that allows access to the drainage system for inspection, cleaning, unblocking, or repair.

Spring Box

A spring box collects water from a spring and conveys it to the underground storm drainage system.

☐ Review

 Documentation Required

BEFORE END WALLS, INLET BOXES, UTILITY HOLES, & SPRING BOXES CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐		Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐		Ensure pre-cast units are checked on arrival to ensure that an inspector at the fabricator has stamped them and that they are stamped with the proper information.	MCDocs
☐		Ensure pre-cast units are checked for damage, such as cracks, spalls, and missing steps.	MCDocs

DURING END WALLS, INLET BOXES, UTILITY HOLES, & SPRING BOXES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the contractor constructs the indicated unit at the location shown on the plans at the correct elevation.	
☐ 	Verify the unit, excavation, and backfill meet the requirements of PUB 408 Section 605 and PUB 72M RC Standards 31M, 36M, 39M, and 46M, and that OSHA standards are followed.	
☐ 	Confirm that the bedding material and backfill material are placed in a manner that meets the requirements of PUB 72M RC Standard 39M.	
☐ 	Accept trench backfill material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Verify the finished grade and alignment of the unit are correct.	MCDocs
☐ 	If CIP, confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	ECMS MCDocs

AFTER END WALLS, INLET BOXES, UTILITY HOLES, & SPRING BOXES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document all concrete testing performed in the eConcrete, all concrete placed, batch mixer slips, and concrete delivery tickets were received.	eConcrete

Material & Equipment

The materials required to construct and place inlets, end walls, utility holes, and spring boxes are outlined in PUB 408 Section 605 and PUB 72M RC Standards 31M, 36M, 39M, and 46M. If inlets, end walls, utility holes, or spring boxes are pre-cast at a fabrication plant, they must arrive on the project stamped by an inspector, as outlined in PUB 2. They also must be stamped with the

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information required by PUB 408 Section 714. All materials used must be from suppliers listed on the contractor's approved material source of supply.

The contractor needs an excavator, such as a backhoe, excavator, or gradall, to excavate for the inlet, end wall, utility hole, or spring box. The contractor needs a front end loader or an excavator to place backfill material and a vibratory plate compactor to compact backfill. A dump truck is necessary to haul excess excavated material to an approved waste area.

If the contractor is placing pre-cast units, a backhoe, gradall, or excavator could be used to set these in place. If the unit is CIP, the contractor needs concrete testing equipment meeting the requirements of PUB 408 Section 704 to test the concrete as specified in PUB 408 Section 704 and the contractor's concrete QC plan.

A survey transit is required to establish finish grades for the inlet, end wall, utility hole, or spring box.

Mechanical:				
Backhoe	Dump Truck	Excavator	Front End Loader	Gradall
Vibratory Plate Compactor				
Hand Tools:				
Concrete Vibrator	Shovel			
Testing/Inspection:				
Concrete Testing Equipment	Survey Transit			

Construction Methods

The inlet, end wall, utility hole, or spring box location is laid out, and offset stakes are set with the bottom of box elevations. The contractor uses these to control the excavation.

Excavation is completed, and bedding is placed and compacted.

If CIP concrete is used, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

Forms are constructed to the dimensions shown on the standard drawings for the type indicated in PUB 72M RC Standard 39M, and concrete is placed. After the concrete is cured, the forms are removed, and the structure is backfilled. The backfill material is compacted to visual non-movement under compaction equipment.

If the contractor uses pre-cast units, the bedding is prepared, the units are set into place, and the units are backfilled.

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After the inlet box and the adjoining pipe are in place, a small amount of concrete is placed in the bottom of the box to create flow lines. The placed concrete is hand-troweled to create a depressed channel that ties in with the pipe.

Measuring & Payment Methods

Inlets, utility holes, and spring boxes are paid for each complete in-place, which includes excavation and backfill of the structure.

End walls can be paid for individually or by the cubic yard for the class of concrete indicated. This item is field-measured and computed on a PSA.

End wall excavation is paid in cubic yards for the class of excavation indicated, which is field-measured. All computations are shown on a PSA.

4. GRADE ADJUSTMENTS OF EXISTING MISCELLANEOUS STRUCTURES (SEC. 606)

This section addresses grade adjustments of existing inlets, utility holes, or utility boxes to a vertical height of 6 inches or less.

☐ Review  Documentation Required

BEFORE GRADE ADJUSTMENTS OF EXISTING MISCELLANEOUS STRUCTURES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Ensure pre-cast units are checked on arrival to ensure that an inspector at the fabricator has stamped them and that they are stamped with the proper information.	MCDocs
☐ 	Ensure pre-cast units are checked for damage, such as cracks, spalls, and missing steps.	MCDocs
☐ 	Verify the type of structure adjusted and ensure the adjustment to the structure is not greater than 6 inches.	MCDocs

DURING GRADE ADJUSTMENTS OF EXISTING MISCELLANEOUS STRUCTURES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	If CIP, confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Confirm the top of the structure is set at the finished grade.	MCDocs

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☐		Task	Reference
☐		Ensure that the structures being adjusted and other structures affected by adjustment operations are backfilled according to standards and specifications.	MCDocs
☐		Accept subbase material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	

AFTER GRADE ADJUSTMENTS OF EXISTING MISCELLANEOUS STRUCTURES CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document all concrete testing performed in the eConcrete, all concrete placed, batch mixer slips, and concrete delivery tickets were received.	eConcrete

Material & Equipment

The material used must conform to the requirements specified for new structures of the type indicated and meet the requirements of PUB 408 Section 606. Adjustments can be made with CIP concrete or pre-cast extensions.

Sometimes, the contractor uses extensions that are pre-cast by a manufacturer listed in PUB 35 Bulletin 15 and by a fabricator listed on the contractor's approved material source of supply. Pre-cast extensions must be inspected and stamped by the manufacturer's inspector at the manufacturer and should arrive on the project stamped as outlined in PUB 2 Section C.6.5. All materials used must be from suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment, such as a backhoe, excavator, or gradall, to excavate around the structure that is to be adjusted. A concrete saw may be needed to saw the existing structure within the limits of removal. An air compressor is necessary to run jackhammers to remove the existing structure, and a vibratory plate compactor is needed to compact backfill material after the rehabilitation is complete.

If the structure adjustment involves CIP concrete, concrete testing equipment is required. Generators may be needed to run the electrical hand tools for constructing forms. A dump truck is necessary to haul debris to an approved waste area.

A survey transit is required to set grades for the structure that is to be raised. If the structure adjustments are CIP, concrete testing equipment, as specified in PUB 408 Section 704, would be used.

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The inspector needs a device to measure vertical inches, such as a tape measure or an engineer ruler, to check the height of the adjusted structure.

Mechanical:				
Air Compressor	Backhoe	Concrete Saw	Dump Truck	Excavator
Generator	Gradall	Jackhammer	Vibratory Plate Compactor	
Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
4-foot Smart Level	Concrete Testing Equipment	Engineer Ruler	Survey Transit	Tape Measure

Construction Methods

The contractor places off-set grade stakes with finish grades marked on them at the structure to be adjusted, and the structure is marked at the removal line. A concrete saw is used to saw the existing structure at the removal line (if removal is necessary). The saw cut is made about 1 inch deep.

The portion of the structure to be removed is removed using jackhammers. If a pre-cast unit is placed, the contractor places a full bed of mortar on the existing structure and sets the pre-cast unit in place. If the work involves CIP concrete, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. The contractor constructs forms, places reinforcement as required, and places the required class of concrete. After the concrete is cured, the structure is backfilled. The backfill material is compacted to visual non-movement under compaction equipment.

Measuring & Payment Methods

Grade adjustments are paid for by the set, complete in place, which includes removing and cleaning the existing casting, constructing the structure walls to the required elevation, and replacing casting on a full mortar bed as required.

5. REBUILT MISCELLANEOUS STRUCTURES (SEC. 607)

This section addresses the rebuilding of existing inlets, utility holes, or utility boxes with heights in excess of 6 inches.

☐ Review  Documentation Required

BEFORE REBUILT MISCELLANEOUS STRUCTURES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify the type of structure rebuilt.	
☐ 	Ensure pre-cast units are checked on arrival to ensure that an inspector at the fabricator has stamped them and that they are stamped with the proper information.	MCDocs
☐ 	Ensure pre-cast units are checked for damage, such as cracks, spalls, and missing steps.	MCDocs

DURING REBUILT MISCELLANEOUS STRUCTURES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Verify the vertical adjustment is to grade and is greater than 6 inches.	MCDocs
☐ 	If CIP, confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs

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☐		Task	Reference
☐		Confirm the structure is rebuilt to meet the requirements of PUB 408 Section 605.	MCDocs
☐		Ensure that the structures being adjusted and other structures affected by adjustment operations are backfilled according to standards and specifications.	MCDocs
☐		Accept subbase material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	

AFTER REBUILT MISCELLANEOUS STRUCTURES CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The material must conform to the requirements specified for new structures of the type indicated as outlined in PUB 408 Section 605. All materials used must be from suppliers listed on the contractor's approved material source of supply.

If CIP concrete is used, it must meet the requirements of PUB 408 Section 704 and the contractor's concrete QC plan. If pre-cast risers are used, they must be inspected and stamped by the manufacturer's inspector and should arrive on the project stamped.

The contractor needs equipment, such as a backhoe, excavator, or gradall, to excavate around the structure that is to be rebuilt. A concrete saw may be needed to saw the existing structure within the limits of removal. An air compressor and jackhammers are necessary to remove the existing structure, and a vibratory plate compactor is needed to compact the backfill material after the rebuild is complete.

If the structure rebuild involves CIP concrete, concrete testing equipment is required, as specified in PUB 408 Section 704. Electrical hand tools and the generators to run them may be needed in constructing forms. A dump truck is necessary to haul excess debris to an approved waste area.

A survey transit is required to set grades for the rebuilt structure.

The inspector needs a device to measure vertical inches to check the height of the structure.

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Mechanical:				
Air Compressor	Backhoe	Concrete Saw	Dump Truck	Excavator
Generator	Gradall	Jackhammer	Vibratory Plate Compactor	
Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
Concrete Testing Equipment	Engineer Ruler	Survey Transit	Tape Measure	

Construction Methods

The contractor places offset stakes, with finish grades and alignment marked on them, on the shoulder of the road. A level and string line are used to match the finish grade and alignment, while the stakes are used to control the depth and alignment of the rebuilt portion of the structure.

The structure is marked at the removal line and cut about 1 inch deep at this line with a concrete saw, creating a smooth edge. A jackhammer is used to remove the remaining portion of the structure. Debris from demolition is hauled to an approved waste area.

If pre-cast risers are used to rebuild the structure, a full bed of mortar is placed on the existing surface before placing the riser. If the rebuilt structure is cast in place, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. The contractor constructs the forms to grade and places the required class of concrete. After the concrete has cured, the structure is backfilled. The backfill material is compacted to visual non-movement under compaction equipment.

Measuring & Payment Methods

Rebuilt items are paid for by the vertical foot, which is field-measured. Payment calculations are made on a PSA.

6. PIPE UNDERDRAIN & PAVEMENT BASE DRAIN (SEC. 610)

This section addresses the construction of pipe underdrains and pavement base drains. The drains channel water from pavement areas.

☐ Review  Documentation Required

BEFORE PIPE UNDERDRAIN & PAVEMENT BASE DRAIN CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING PIPE UNDERDRAIN & PAVEMENT BASE DRAIN CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the trench is excavated to the dimensions shown on PUB 72M RC Standard 30M.	
☐ 	Verify aggregate, geotextile, and backfill are placed per PUB 72M RC Standard 30M.	
☐ 	Ensure the coarse aggregate used for backfilling is consolidated using a vibratory plate tamper, as a roller could damage the pipe. Document consolidation on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Accept pipe trench backfill material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Confirm excess excavated material from the pipe trench is hauled to an approved waste area.	MCDocs

AFTER PIPE UNDERDRAIN & PAVEMENT BASE DRAIN CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The material used to construct the pipe is outlined in PUB 408 Section 610 and must meet the requirements of the applicable PUB 408 sections. The coarse aggregate used for backfilling must meet the requirements of PUB 408 Section 703 and PUB 72M RC Standard 30M for the type of pipe installation required. Class 1 geotextile used to encapsulate the coarse aggregate, as shown on the standard drawings, must meet the requirements of PUB 408 Section 212. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor may use a trencher or backhoe to excavate the trench for the pavement base drain and underdrain. A trench roller or a vibratory plate compactor is needed to compact the bottom of the trench after it is excavated.

A vibratory plate compactor is used to consolidate the coarse aggregate after it is placed atop the pipe, while a dump truck with a chute or a front end loader is used to place aggregate in the trench.

The contractor needs a measuring device, such as a tape measure, to lay out the pipe location, which is then marked with marking paint.

The inspector also needs a tape measure or engineer ruler to measure the pipe trench depth and width to ensure it is excavated according to the requirements of PUB 72M RC Standard 30M.

The contractor needs a survey transit to control the grade of the pipe. Grade stakes are usually set every 50 feet.

Mechanical:				
Backhoe	Dump Truck	Front End Loader	Trench Roller	Trencher
Vibratory Plate Compactor				
Testing/Inspection:				
Engineer Ruler	Tape Measure			

Construction Methods

Pipe underdrains and pavement base drains are normally installed after the subbase is placed. The contractor marks out the pipe run with points and marks all outlets. Some outlets run out of the slope on the side of the road, and some connect to draining outlet boxes. The contractor then excavates the trench using a trencher or backhoe. The bottom of the trench is rolled with a trench roller or compacted with a vibratory plate compactor.

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If geotextile is used, the trench is lined with the geotextile and a small amount of coarse aggregate is placed at the bottom of the trench prior to laying the pipe. The entire trench is then filled with coarse aggregate and consolidated with a vibratory plate compactor.

Measuring & Payment Methods

Pipe underdrains, pavement base drains, and Class 1 geotextiles are paid for by the linear foot. After installation, these are field-measured, and a payment calculation is made on a PSA.

If the contractor is required to excavate the trench deeper than the depth shown on the standard drawing, the contractor is paid extra for anything over the required depth shown in the PUB 72M RC Standard 30M. This extra payment is made using Class 4 excavation. Additional coarse aggregate placed because of the extra trench excavation is paid for by the cubic yard. This is field-measured and computed on a PSA.

7. SUBGRADE DRAINS (SEC. 612)

This section addresses the construction of a drain in the subgrade to channel water from under the pavement area. The subgrade drain is constructed when a water problem is encountered. In addition to channeling water, the drain helps stabilize the subgrade and make a solid grade for the placement of the subbase.

☐ Review  Documentation Required

BEFORE SUBGRADE DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING SUBGRADE DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the slope of the drain meets the requirements of PUB 408 Section 612.	
☐ 	Confirm the trench is excavated to the dimensions shown on PUB 72M RC Standard 30M.	
☐ 	Verify what type of coarse aggregate was used for backfilling and, if required, that the subgrade drain was enclosed with Class 1 geotextile, as outlined in PUB 408 Section 612.	
☐ 	Ensure the coarse aggregate used for backfilling is consolidated using a vibratory plate tamper, as a roller could damage the pipe. Document consolidation on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Accept pipe trench backfill paving material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Ensure subgrade drains are outleted, as outlined in PUB 408 Section 615.	

AFTER SUBGRADE DRAINS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The contractor uses coarse aggregate as indicated in PUB 408 Section 612 and PUB 72M RC Standard 30M. Geotextile is used to enclose the coarse aggregate, as indicated in PUB 72M RC Standard 30M. The geotextile must meet the requirements of PUB 408 Section 735. Where geotextile is not indicated, asphalt paper must be used, as shown in the PUB 72M RC Standard 30M. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a trencher, backhoe, or gradall to excavate the subgrade trench. The equipment must be capable of excavating the trench to the dimensions shown on PUB 72M RC Standard 30M for the type indicated.

A trench roller or vibratory plate compactor is required to compact the bottom of the trench and the backfill. The contractor also needs equipment, such as a dump truck with a chute, a front end loader, or gradall, to place coarse aggregate backfill.

The contractor needs a survey transit to control the grade of the trench.

The inspector needs a device, such as a tape measure or engineer ruler, to measure the width and depth of the subgrade drain trench to ensure it meets the requirements of PUB 72M RC Standard 30M.

Mechanical:				
Backhoe	Dump Truck	Front End Loader	Gradall	Trench Roller
Trencher	Vibratory Plate Compactor			
Testing/Inspection:				
Engineer Ruler	Survey Transit	Tape Measure		

Construction Methods

The IIC lays out the location for the subgrade drain. The contractor, using an acceptable method, excavates the subgrade drain trench. A survey transit is used to control the grade to ensure it meets the proper slope requirements.

The contractor places a Class 1 geotextile, if required, at the bottom of the excavation. After the geotextile is placed, the contractor backfills with coarse aggregate per PUB 72M RC Standard

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30M. The coarse aggregate is compacted using an acceptable method. If geotextile is not required, asphalt paper is placed on top of coarse aggregate backfill.

Measuring & Payment Methods

Subgrade drains are paid for by the linear foot, which includes the backfill and asphalt paper used to place the drain. The subgrade drain is field measured, and a payment is made on a PSA.

Geotextile is also paid for by the linear foot. Geotextile is field measured, with payment made on a PSA.

8. STONE BACKFILL FOR MISCELLANEOUS DRAINAGE (SEC. 613)

This section addresses the furnishing and placing of stone backfill for miscellaneous drainage, such as sumps, springs, wells, and sink holes, as indicated or directed.

☐ Review  Documentation Required

BEFORE SUBGRADE DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING SUBGRADE DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the material used is the material outlined on contract documents for the type of work being performed.	MCDocs
☐ 	If the use of local stone was permitted, verify that it met the requirements of PUB 408 Section 613 and that No. 57 stone was placed on top in a 6-inch layer.	

AFTER SUBGRADE DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The coarse aggregate used in this work is type C or better (such as No. 1 and No. 57 aggregate); steel slag is not to be used. The contractor, if allowed, can use acceptable, clean, sound, hard, and durable slabs of local stone no larger than 6 inches in any dimension. If local stone is used, the contractor must place a 6-inch layer of No. 57 stone on top. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

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The coarse aggregate must meet the requirements of PUB 408 Section 703. Class 1 geotextile, meeting the requirements of PUB 408 Section 735, is used to enclose the coarse aggregate.

The contractor needs equipment capable of placing coarse aggregates, such as an excavator, gradall, backhoe, or front end loader. The equipment is acceptable if it can properly place the aggregate in the drainage structure.

The inspector needs a tape measure or engineer ruler to measure trench excavation.

Mechanical:				
Backhoe	Excavator	Front End Loader	Gradall	
Testing/Inspection:				
Engineer Ruler	Tape Measure			

Construction Methods

This work is job-specific, as outlined in the project documents. The contractor places the stone and geotextile according to the job requirements.

Measuring & Payment Methods

This work is paid for by the cubic yard. The aggregate backfill area is field measured, with computation and payment shown on a PSA.

9. SUBSURFACE DRAIN OUTLETS (SEC. 615)

This section addresses the construction of subsurface drain outlets for pavement base drains and underdrains.

☐ Review  Documentation Required

BEFORE SUBSURFACE DRAIN OUTLETS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure pre-cast units are checked on arrival to ensure that an inspector at the fabricator has stamped them and that they are stamped with the proper information.	MCDocs
☐ 	Ensure pre-cast units are checked for damage, such as cracks and spalls.	MCDocs

DURING SUBSURFACE DRAIN OUTLETS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the outlet pipe meets the requirements of PUB 408 Section 615.	
☐ 	Verify the pipe has positive gravity flow to the outlet.	
☐ 	Ensure that if plastic pipe is used, a concrete end wall is used on the outlet end.	
☐ 	Confirm the trench is excavated to the dimensions shown on PUB 72M RC Standard 30M.	
☐ 	Verify that a red flexible delineator was placed at the end wall.	

AFTER SUBSURFACE DRAIN OUTLETS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Materials used in this work include a solid pipe meeting the requirements of PUB 408 Sections 610 and 615. Unless otherwise directed, the outlet pipe should be made of the same material as the underdrain or pavement base drain.

If indicated on the plans or as directed, the contractor needs concrete outlet end walls for the end of outlet plastic pipes, meeting the requirements of PUB 72M RC Standard 31M. In addition, the contractor needs flexible red delineators, meeting the requirements of PUB 408 Section 615 and PUB 111 TC Standard 8604, to be placed at the end wall to mark the location of the outlet. All materials used must be from suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe, gradall, excavator, or trencher capable of excavating the pipe trench to the dimensions shown on PUB 72M RC Standard 30M. A vibratory plate compactor is used to compact the pipe trench bottom, and the backfill is placed on top of the pipe. To place backfill material, the contractor needs a backhoe, front end loader, gradall, or excavator. If pre-cast concrete end walls are required, a backhoe is used to place them.

The contractor needs a survey transit and a measuring device to lay out the outlets and control the slope of the outlet pipe.

The inspector needs a tape measure or engineer ruler to check the dimensions of the pipe trench excavation and of the concrete end wall to ensure that they meet the requirements of PUB 72M RC Standards 30M and 31M.

Mechanical:				
Backhoe	Excavator	Front End Loader	Gradall	Trencher
Vibratory Plate Compactor				
Testing/Inspection:				
Engineer Ruler	Survey Transit	Tape Measure		

Construction Methods

The contractor lays out the outlet location and excavates the trench to meet the requirements of PUB 72M RC Standard 30M and contract documents. A 2-inch layer of embankment material is then placed and compacted using a vibratory plate compactor.

The pipe is placed and connected to the base drain or underdrain with bands or split couplings. The outlet ends of the pipes are connected to the pre-cast or CIP end walls, or they are outleted into an existing drainage structure. CIP end walls must meet the requirements of PUB 72M RC Standard 31M.

After the pipe is placed, the trench is backfilled with embankment material. This backfill is placed in 4-inch lifts and thoroughly tamped. Lastly, if an end wall is used, a red flexible delineator is placed at the outlet to mark the location.

Measuring & Payment Methods

The outlet pipe is paid by the linear foot and includes the excavation up to 36 inches deep. The pipe is field-measured and paid on a PSA.

If the contractor is required to excavate the trench more than 36 inches in depth or 24 inches in width, the extra excavation is paid as Class 4 excavation in cubic yards. This is also field-measured and computed on a PSA.

Each subsurface drain outlet end wall and red subsurface drain outlet markers are paid individually, utilizing the quantity of each. These are field-counted and paid on a PSA.

10. END SECTIONS & SLOPE PIPE FITTINGS (SEC. 616)

This section addresses the construction of end sections and slop pipe fittings.

☐ Review  Documentation Required

BEFORE END SECTIONS & SLOPE PIPE FITTINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING END SECTIONS & SLOPE PIPE FITTINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the type of end section or pipe fitting placed meets the requirements of PUB 408 Sections 601 and 616, PUB 72M RC Standards 32M and 33M, and the plan documents and specifications.	
☐ 	Verify the excavation, placement of the end section, and backfill meet the requirements of PUB 408 Sections 601 and 615 and PUB 72M RC Standards 32M and 33M.	
☐ 	If CIP, confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	If concrete end sections are used, confirm they have a stamp from the manufacturer with the requirements of PUB 2 Part C.6.5.	MCDocs
☐ 	Ensure the trench is excavated to the dimensions shown on PUB 72M RC Standard 30M.	

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☐		Task	Reference
☐		Accept pipe trench backfill material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	

AFTER END SECTIONS & SLOPE PIPE FITTINGS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The end sections for pipe culverts can be made of concrete, metallic-coated steel, or aluminum alloy, meeting the requirements of PUB 408 Section 601. The slope pipe fittings are made of steel that meets the requirements of PUB 408 Section 601 and PUB 72M RC Standard 32M. Coarse aggregate that meets the requirements of PUB 408 Section 703 is used for backfilling, as indicated for slope pipes in PUB 72M RC Standard 32M. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment, such as a backhoe, excavator, or gradall, to excavate for the end sections and slope pipe fittings. An excavator, backhoe, front end loader, or gradall is used to place end sections and slope pipe fittings and backfill them. A vibratory plate compactor is needed to compact the backfill material.

The contractor needs a survey transit to establish the grade for the end section or slope pipe. The established grade is used to control the slope of the pipe to ensure it meets plan requirements. The contractor may also need a nuclear gauge to check the backfill compaction density.

Mechanical:				
Backhoe	Excavator	Front End Loader	Gradall	Vibratory Plate Compactor
Testing/Inspection:				
Nuclear Gauge	Survey Transit			

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Construction Methods

The contractor sets grades for the end section or slope pipe and excavates to these grades. The contractor then places the end section or slope pipe and backfills in 4-inch lifts to achieve the required compaction.

Measuring & Payment Methods

End sections or slope pipe fittings are paid each on a PSA when they are completely in place. Payment includes excavation and backfill.

11. SLOTTED DRAINS (SEC. 617)

This section addresses the construction of drains with continuous slotted openings.

☐ Review  Documentation Required

BEFORE SLOTTED DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure pre-cast units are checked for damage, such as cracks and spalls.	MCDocs

DURING SLOTTED DRAINS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the excavation, the placement of the drain, and the backfill are completed per PUB 408 Section 617.	MCDocs
☐ 	Accept pipe trench backfill material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Confirm if pre-cast polymer concrete troughs are used and that the excavation, the placement, and the backfill are performed according to the manufacturer's recommendations.	
☐ 	Verify that if a slotted pipe is used, excavation and backfill are completed per PUB 408 Section 601 and PUB 72M RC Standard 30M.	
☐ 	Confirm the drain is adequately supported until adjacent construction is completed.	

AFTER SLOTTED DRAINS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Slotted drains are fabricated from metallic-coated steel pipes, meeting the requirements of PUB 408 Section 601, or pre-cast polymer concrete troughs as listed in PUB 35 Bulletin 15 and certified per PUB 408 Section 106. The coarse aggregate used to backfill around the slotted drain must meet the requirements of PUB 408 Section 350. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe, excavator, or gradall capable of excavating the trench to the requirements of PUB 72M RC Standard 30M for pipe and to the manufacturer's recommendations for pre-cast polymer concrete sections.

A backhoe, front end loader, or excavator is used to place pipe in the trench and to backfill the material according to the requirements of PUB 408 Section 350. The contractor also needs compaction equipment, such as a walk-behind roller or vibratory plate compactor, to compact the backfill material to the requirements of PUB 408 Section 350.

The contractor needs a survey transit to lay out the pipe and establish grades to control pipe placement. Grades for the pipe placement are marked on offset stakes. The contractor and the inspector need a device, such as a tape measure or engineer ruler, to measure the pipe trench to ensure it meets the required specifications.

Mechanical:				
Backhoe	Excavator	Front End Loader	Gradall	Vibratory Plate Compactor
Walk-Behind Roller				
Testing/Inspection:				
Engineer Ruler	Survey Transit	Tape Measure		

Construction Methods

The contractor lays out the pipe location and sets grade stakes to control the grade of the pipe trench excavation and pipe placement. The contractor then excavates the trench and places the pipe. The contractor must follow the manufacturer's recommendations for pre-cast polymer concrete troughs.

The contractor places and compacts the backfill material according to the requirements. Temporary covers are placed over the drain during construction to prevent foreign materials from infiltrating the drain.

Measuring & Payment Methods

Slotted drains are paid for by the linear foot. At the completion of the work, the drain is field-measured and paid on a PSA.

12. CONCRETE COLLAR FOR PIPE EXTENSION (SEC. 618)

This section addresses the construction of a pipe collar for extending pipes from an end wall or other structure.

☐ Review  Documentation Required

BEFORE CONCRETE COLLAR FOR PIPE EXTENSION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING CONCRETE COLLAR FOR PIPE EXTENSION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Verify the existing end wall is prepared per PUB 408 Section 618 and PUB 72M RC Standard 32M.	MCDocs
☐ 	Ensure the contractor constructs forms for the collar to the dimensions shown on PUB 72M RC Standard 32M and per PUB 408 Section 618.	MCDocs
☐ 	Verify that the pipe was placed and backfilled per PUB 408 Section 618 and PUB 72M RC Standard 30M.	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Verify the pipe and backfill meet the requirements for their type per PUB 72M RC Standard 30M.	

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☐		Task	Reference
☐		Accept pipe trench backfill material compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	

AFTER CONCRETE COLLAR FOR PIPE EXTENSION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The contractor uses non-shrinking mortar to grout reinforcement in place, as shown in PUB 72M RC Standard 32M. The mortar must meet the requirements of PUB 408 Section 1001. Number 5 rebar, meeting the requirements of PUB 408 Section 709, is used for dowels as shown on PUB 72M RC Standard 32M. Class A concrete that meets the requirements of PUB 408 Section 704 and the concrete QC plan is needed to construct the collar as shown on PUB 72M RC Standard 32M; the contractor must also have appropriate concrete testing equipment. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor may need an air compressor to operate jackhammers to remove a portion of the existing end wall footer if required. The air compressor may also be used to operate an air drill to drill holes in the existing end wall for the placement of reinforcement, as shown in PUB 72M RC Standard 32M.

The contractor needs equipment, such as a backhoe, excavator, or gradall, to excavate the pipe trench per PUB 72M RC Standard 32M. Equipment, including a front end loader, backhoe, excavator, or gradall, is required to place the pipe and backfill material. To compact the pipe trench backfill, the contractor needs equipment such as a vibratory plate compactor or walk-behind roller capable of compacting the backfill to the required density.

The contractor uses a survey transit to establish grades for the pipe extension. Grades are marked on offset stakes at the location of the pipe. The contractor may also use a laser level to control the grade and the alignment of the pipe being placed. The contractor's certified technician will test the concrete in accordance with PUB 408 Section 704.

The inspector needs a measuring tape or an engineer ruler to check the dimensions of the excavation.

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Mechanical:				
Air Compressor	Backhoe	Excavator	Front End Loader	Gradall
Jackhammer	Vibratory Plate Compactor	Walk-Behind Roller		
Hand Tools:				
Concrete Vibrator	Laser Level	Pneumatic Air Drill		
Testing/Inspection:				
Concrete Testing Equipment	Engineer Ruler	Survey Transit	Tape Measure	

Construction Methods

The contractor, using a survey transit, places grade stakes to control the excavation for pipe extension. Existing end wall portions are removed if required by plan documents.

The contractor drills 1-inch holes for reinforcement, as shown on PUB 72M RC Standard 32M, then grouts the reinforcement in the holes using a non-shrink mortar. The pipe extension is then set in place. Forms are constructed for placing Class A concrete to the dimensions shown on PUB 72M RC Standard 32M. Prior to placement, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

After the concrete is cured, the pipe is backfilled to meet the requirements of PUB 72M RC Standard 30M.

Measuring & Payment Methods

Concrete collars for pipe extensions are paid as a lump sum, which includes all work and material.

13. PERMANENT IMPACT ATTENUATING DEVICES (SEC. 619)

This section addresses furnishing and installing a permanent impact-attenuating device, including all components and hardware.

☐ Review  Documentation Required

BEFORE PERMANENT IMPACT ATTENUATING DEVICES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review any applicable Non-Standard Condition Documents that were created by the designer of record for installations that do not meet the standard or manufacturer's requirements.	MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify that the contractor has completed the necessary training per PUB 408 Section 619.	

DURING PERMANENT IMPACT ATTENUATING DEVICES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the attenuator was installed according to the manufacturer's specifications for the type indicated on the roadway plans.	MCDocs

AFTER PERMANENT IMPACT ATTENUATING DEVICES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Complete and submit Roadside Barriers and End Treatments Design and Construction Checklists per PUB 2 Part C.6.13.	

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☐		Task	Reference
☐		Create a redline markup of contract documents for any field changes, if applicable. Discuss completing the necessary Non-Standard Condition Documents with the supervisor.	MCDocs
☐		Document the installation or removal of the permanent guide rail, end treatments, cable barrier, and concrete barrier in the PA Guide Rail app.	PA Guide Rail

Material & Equipment

The material used is job-specific for the type of permanent impact-attenuating device required. The attenuator is supplied by a manufacturer listed in PUB 35 Bulletin 15; the contractor submits information regarding the manufacturer of the attenuator for approval prior to performing any work. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

Refer to PUB 408 Section 619 and PUB 2 Part C.6.15 for guidance on the installation training needed for projects that include permanent impact attenuating devices. PUB 408 provides guidance for installers, and PUB 2 provides guidance for inspectors.

Depending on the type of end treatment required, the contractor may need a truck-mounted post driver, a power auger, and an air compressor. The post driver and power auger are used to install wooden posts for certain types of end treatments, while the air compressor is used to operate hand tools to install the device.

The contractor may need a 4-foot level to level the attenuator during installation, depending on the type of attenuator required.

Mechanical:				
Air Compressor	Power Auger	Truck-Mounted Post Driver		
Testing/Inspection:				
4-foot Smart Level				

Construction Methods

The contractor installs the attenuator specified on the plan at the end of the guide rail run. As there are various manufacturers of permanent impact attenuating devices, the specific instructions for the type used must be followed.

Measuring & Payment Methods

Attenuators are paid as individual items, including tail-end treatment when required by plan specifications. Fill out the construction portion of the Roadside Barriers and End Treatments

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Design 7 Construction Checklists per PUB 2. The designers provide the design portion of the checklist in the Project Development Checklist within ECMS.

Items that are not installed per the PUB 72M RC Standards 50M through 59M must have non-standard documentation as per PUB 2. If not already completed for the project by the designers, this documentation must be completed during construction.

14. GUIDE RAIL (SEC. 620)

This section addresses the installation of new guide rails, the resetting of existing rails, and the removal of existing guide rails.

☐ Review  Documentation Required

BEFORE GUIDE RAIL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review any applicable Non-Standard Condition Documents that were created by the designer of record for installations that do not meet the standard or manufacturer's requirements.	MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify that the contractor has completed the necessary training per PUB 408 Section 620.	

DURING GUIDE RAIL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Ensure concrete anchor blocks are constructed per PUB 72M RC Standards 51M and 53M.	
☐ 	Confirm the guide rail is laid out and erected for the type indicated per PUB 72M RC Standards 50M, 51M, and 53M and PUB 408 Section 620.	

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☐		Task	Reference
☐		Ensure the post driver does not damage any of the guide rail posts when driving them in place.	MCDocs
☐		Confirm all bolts are tightened.	MCDocs
☐		Verify satisfactory protection is provided at exposed, unfinished ends of guide rails.	MCDocs
☐		Confirm the guide rails are attached to posts driven during the day before the end of the day.	MCDocs
☐		If the guide rail is removed, document its location and where it was disposed of. Refer to the contract documents for proper disposal of the guide rail.	MCDocs
☐		If the guide rail is reset, document the location of the removed guide rail, where the guide rail was stored, and where the guide rail was reset.	MCDocs

AFTER GUIDE RAIL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Create a redline markup of contract documents for any field changes, if applicable, and discuss completing the necessary Non-Standard Condition Documents with the supervisor.	MCDocs
☐		Document the installation or removal of the permanent guide rail, end treatments, cable barrier, and concrete barrier in the PA Guide Rail app.	PA Guide Rail

Material & Equipment

The material used for guide rail posts and rails must meet the requirements of PUB 408 Sections 1109 and 1119.

Concrete and rebar are used to construct anchor blocks per RC Standards 51M and 53M. The contractor uses Class A cement concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan; the contractor must also have appropriate concrete testing equipment. Rebar must meet the requirements of PUB 408 Section 709. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor uses a truck-mounted mechanical post driver to drive the guide rail post. The driver should be capable of driving the post plumb without damaging the guide rail post. The contractor needs excavating equipment (backhoe) or a power auger to excavate the end anchor blocks to

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the dimensions required in the PUB 72M RC Standards 50M, 51M, and 53M. Usually, an air compressor is used to operate hand tools, such as air wrenches and pneumatic air drills, used to erect the guide rail and tighten bolts on the guide rail.

If the contractor is to remove the guide rail, equipment capable of pulling existing posts, such as a truck-mounted post driver, is needed, as is a flatbed truck to haul the post and rail off of the project.

The contractor and inspector need a 4-foot level to check guide rail posts to ensure they are plumb. The contractor and inspector also need a tape measure capable of measuring feet to lay out and check the spacing on the guide rail posts to ensure they meet the requirements of PUB 72M RC Standards 50M, 51M, and 53M.

Mechanical:				
Air Compressor	Backhoe	Flatbed Truck	Power Auger	Truck-Mounted Post Driver
Hand Tools:				
Concrete Vibrator	Pneumatic Air Drill	Wrench		
Testing/Inspection:				
4-foot Smart Level	Concrete Testing Equipment	Tape Measure		

Construction Methods

The contractor lays out the location of the guide rail, with each post location marked. The contractor uses a level and string line stretched on stakes at the front face of the post to control alignment.

The contractor drives the guide rail posts so that they are plumb, aligned, and properly spaced. The contractor then hangs the offset brackets and rail sections on the posts and tightens all bolts. If resetting of the guide rail is required, the contractor takes down the guide rail, stores it until construction is complete, and then reinstalls the rail. If the guide rail is removed and is not going to be reused, it is hauled away from the job site. Galvanizing is applied to damaged or field-cut areas.

Construct the concrete anchor blocks as required. The contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

Measuring & Payment Methods

Guide rail that is newly installed, reset, or removed is paid by linear foot. The guide rail is field-measured and paid on a PSA.

End anchors and end treatments are paid as individual items and are paid on a PSA when completed in place.

15. TEMPORARY IMPACT ATTENUATING DEVICES & RESETS (SEC. 696 & 697)

This section addresses the furnishing, placing, resetting, and removing of temporary impact attenuating devices for the maintenance and protection of traffic (MPT) during construction.

☐ Review  Documentation Required

BEFORE TEMPORARY IMPACT ATTENUATING DEVICES & RESETS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify that the contractor has completed the necessary training per PUB 408 Sections 696 and 697.	

DURING TEMPORARY IMPACT ATTENUATING DEVICES & RESETS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the attenuator was installed according to the manufacturer's specifications for the type indicated on the MPT plan.	MCDocs
☐ 	If a temporary attenuator is reset, document the reset location and that it was reset according to the manufacturer's specifications.	MCDocs

AFTER PERMANENT IMPACT ATTENUATING DEVICES & RESETS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The impact attenuator must be supplied by a manufacturer listed in PUB 35 Bulletin 15. The contractor submits shop drawings of the attenuator for approval prior to construction to ensure

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the device meets plan specifications. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor may need a portable generator to power the hand tools used for anchoring the attenuator to the existing pavement, as well as a level to install the attenuator if required by the manufacturer's specifications.

Mechanical:				
Generator				
Testing/Inspection:				
Smart Level				

Construction Methods

The contractor submits shop drawings of the temporary attenuators to the Department for approval prior to performing any work.

The contractor places the temporary attenuator of the type indicated on the MPT plan. The attenuator is placed per the manufacturer's specifications. If the temporary attenuator is reset, the contractor removes the attenuator from one construction area and resets it at another location as indicated within the project limits.

Measuring & Payment Methods

Temporary impact attenuating devices are paid for individually, by the quantity of each, which includes placement and removal. After placement, the temporary attenuating device is paid for on a PSA.

The Department will pay for the repair of temporary attenuating devices by force account. Temporary attenuators that have been reset are paid each once they have been moved from one location and reset in another.

16. CONCRETE MEDIAN BARRIER (SEC. 623)

This section addresses the construction of a concrete median barrier that is placed to prevent traffic from crossing the median area into opposing traffic.

☐ Review  Documentation Required

BEFORE CONCRETE MEDIAN BARRIER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING CONCRETE MEDIAN BARRIER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Ensure barrier dimensions meet the requirements of the PUB 72M RC Standard 57M for the type indicated. If CIP, rebar locations, types, and sizes are checked.	
☐ 	Verify that the base was prepared per PUB 72M RC Standard 57M and is within acceptable standards.	
☐ 	If the barrier is cast in place, verify that reinforcement and forms were checked and approved for the placement of concrete.	MCDocs
☐ 	If the barrier is constructed by slip-forming, verify the reinforcement is properly braced to prevent it from shifting out of alignment.	MCDocs

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☐		Task	Reference
☐		Ensure construction joints meet the requirements of PUB 408 Section 623 and PUB 72M RC Standard 57M.	

AFTER CONCRETE MEDIAN BARRIER CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Class AA concrete meeting the requirements of PUB 408 Section 704 is used to construct the median barrier. Materials used to construct CIP, slip-form, or pre-cast concrete barriers in the field are outlined in PUB 408 Section 623 and PUB 72M RC Standard 57M.

If the median barrier is CIP or slip-formed, all concrete tests must meet the requirements of PUB 408 Section 704, and the concrete must be produced from an approved mix design. If the contractor uses a pre-cast concrete barrier, the barrier must be inspected and stamped by an inspector at the fabricator as specified in PUB 2 Part A.2.3. All materials used must meet the requirements shown on the contractor's approved QC plan and be from the suppliers listed on the contractor's approved material source of supply.

The contractor may need a concrete saw to remove existing pavement to place the concrete barrier. To prepare the base, the contractor needs equipment such as a gradall or backhoe. The contractor also needs equipment such as a vibratory steel wheel roller or vibratory plate compactor to compact the base before placing the barrier.

If a slip-form barrier is placed, the contractor needs a slip-form machine capable of placing the concrete to the dimensions shown on the PUB 72M RC Standard 57M. If a pre-cast barrier is specified, the contractor needs equipment to set it in place, such as a gradall or a barrier lift.

If the concrete barrier is CIP or slip-formed, the contractor also needs concrete testing equipment meeting the requirements of PUB 408 Section 704.

Mechanical:				
Backhoe	Barrier Lift	Concrete Saw	Gradall	Slip Form Machine
Vibratory Plate Compactor	Vibratory Steel Wheel Roller			
Hand Tools:				
Concrete Vibrator				

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Testing/Inspection:				
10-foot Straight Edge	Concrete Testing Equipment			

Construction Methods

The contractor prepares the base per the PUB 72M RC Standard 57M and constructs the barrier as CIP, slip form, or pre-cast sections, meeting the requirements of PUB 408 Section 623. If CIP or slip-forming methods are used, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

Regardless of the method, the work involves preparing and setting the base to the proper grade. For slip-form barriers, the rebar cage is set, and the slip-form machine places the concrete around the cage. It is important that the cage is properly braced to prevent the slip-form machine from pushing the rebar out of alignment.

For pre-cast barriers, pre-cast sections are set into place on the base and locked together with a steel plate. When the barrier is cast in place, it is formed and reinforced prior to placing concrete.

Curing is applied as required for both slip-form and CIP barriers.

Measuring & Payment Methods

The concrete median barrier is paid for by the linear foot. This barrier is field-measured and paid on a PSA.

Barrier end survey transitions are paid each and paid on a PSA after completion.

17. PERMANENT BARRICADES (SEC. 678)

This section addresses the construction of permanent barricades.

☐ Review  Documentation Required

BEFORE PERMANENT BARRICADES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure that the barricade meets the requirements of PUB 408 Section 678 and PUB 72M RC Standard 63M.	

DURING PERMANENT BARRICADES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify permanent barricades are erected to the specifications shown in PUB 408 Section 678 and PUB 72M RC Standard 63M.	
☐ 	If concrete footings are constructed, confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that the test results are within the specified limits.	MCDocs

AFTER PERMANENT BARRICADES CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The materials used to manufacture the barricade and construct the permanent barricades in the field must meet the applicable requirements outlined in PUB 408 Section 678 and PUB 72M RC Standard 63M. If concrete footings are required, Class A concrete must meet the requirements of PUB 408 Section 704 and the approved concrete QC plan. The concrete must be supplied by an approved concrete batch plant and mixed using an approved concrete mix design. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs a truck-mounted post driver or a power auger to drive post or auger holes as outlined in PUB 408 Section 678 and PUB 72M RC Standard 63M. In addition, the contractor needs a 4-foot level to plumb vertical posts and level horizontal channels. If concrete footings are used, the contractor needs concrete testing equipment meeting the requirements of PUB 408 Section 704.

Mechanical:				
Power Auger	Truck-Mounted Post Driver			
Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
4-foot Smart Level	Concrete Testing Equipment			

Construction Methods

The contractor lays out the locations for the vertical posts. The vertical posts are either driven or a hole is augured, and the posts are set in concrete footings that meet the requirements of PUB 72M RC Standard 63M.

If a concrete footing is constructed, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. The contractor then erects barricade panels of the type indicated on the plan, per PUB 408 Section 678 and PUB 72M RC Standard 63M.

Measuring & Payment Methods

Permanent barricades are paid by the linear foot to the indicated plan length and field measured to ensure they meet that plan length. Payment for barriers exceeding plan length is made if authorized by the Department.

18. CEMENT CONCRETE SIDEWALKS (SEC. 676)

This section addresses the construction of a cement concrete sidewalk on an aggregate bed.

☐ Review  Documentation Required

BEFORE CEMENT CONCRETE SIDEWALKS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review applicable Americans with Disabilities Act (ADA) specifications if the sidewalk includes ADA ramps. If the designer provided the design, the ramps can be found in the contract documents. If the project utilizes design-build ramps, then the drawings will be submitted by the contractor via PPCC .	MCDocs
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Review any Technically Infeasible Forms (TIFs) and ensure the contractor is in compliance.	

DURING CEMENT CONCRETE SIDEWALKS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	Verify that the foundation area and aggregate base are prepared per PUB 408 Section 676.	
☐ 	Ensure the forms are set to line and grade and the dimensions indicated.	MCDocs

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☐		Task	Reference
☐		Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐		Confirm the joints in the sidewalk are laid out per PUB 408 Section 676.	
☐		Verify the newly constructed sidewalk is protected from pedestrian foot traffic by caution tape, a safety fence, and other measures.	MCDocs

AFTER CEMENT CONCRETE SIDEWALKS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		If the sidewalk includes ADA ramps, Form CS-4401 must be filled out to verify that the ramp has been installed per the design. Deliver the form to the District's ADA Coordinator and notify the contractor of any deficiencies as soon as possible.	

Material & Equipment

Class S concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan, is used to construct the sidewalks. The concrete must be produced by an approved supplier and batched from an approved mix design. The coarse aggregate base material used for the subbase must meet the requirements of PUB 408 Section 350.

Other materials required to construct the sidewalk must meet the applicable requirements listed in PUB 408 Section 676. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs small equipment, such as a backhoe or gradall, to excavate the sidewalk to the dimensions and grade indicated on the project plan and PUB 408 Section 676. Equipment such as a vibratory plate compactor or a small walk-behind roller is used to compact the foundation area and the coarse aggregate bed, as outlined in PUB 408 Section 676. A dump truck or other hauling equipment is used to haul excess excavated material to an approved waste area. The contractor uses a small front end loader to place the coarse aggregate base material.

The contractor needs a survey transit to lay out and set grades for the placement of the sidewalk. If matching the existing sidewalk, the contractor may stretch a level and string line from the existing end to the existing end. The contractor also needs concrete testing equipment meeting

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the requirements of PUB 408 Section 704 to test the concrete placed on the sidewalk, as well as a concrete vibrator to consolidate the concrete.

Mechanical:				
Backhoe	Dump Truck	Front End Loader	Gradall	Vibratory Plate Compactor
Walk-Behind Roller				
Hand Tools:				
Concrete Vibrator	String Line			
Testing/Inspection:				
Concrete Testing Equipment	Smart Level	Survey Transit		

Construction Methods

The contractor lays out and excavates the sidewalk location to grade. The foundation area must be smooth, even, and compacted. The contractor then places and compacts the aggregate base.

Forms are set to line and grade, and the indicated dimensions are shown on the project plan and in PUB 408 Section 676. The inspector must approve the base and forms before placing concrete. The contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

Concrete is then placed, vibrated, finished, and cured. Typically, a broomed finish is applied. After the concrete has cured, the contractor seals the joints. After removing the forms, the contractor backfills along the sidewalk with acceptable embankment material.

The formwork for the sidewalk should be checked with a smart level to confirm that the minimum and maximum slopes are called out in PUB 72M RC Standard 67M and any applicable contract drawings, design-build drawings, and/or TIFs. If the formwork appears to be out of specification, notify your supervisor immediately.

ADA ramps will also require the installation of a detectable warning surface (DWS) per PUB 408 Section 695 and the applicable contract or design-build drawings. The DWS should be installed with the plastic protective cover intact and placed in the concrete after it is placed and struck off. Once the concrete has hardened, the DWS cover can be removed. If the ramp design requires the DWS to be cut, then any partial domes should be cut off by the contractor.

Measuring & Payment Methods

Cement concrete sidewalks are paid for by the square yard. After completion, the sidewalk is field measured, with computations and payment shown on a PSA. Areas beyond plan widths cannot be paid for unless authorized by the department.

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If Class 1A excavation is required to remove unsuitable material below the foundation subgrade elevation, it is paid by the cubic yard. Excavation is also field measured, with computations and payment shown on a PSA.

19. PLAIN CEMENT CONCRETE CURB (SEC. 630)

This section addresses the construction of a plain cement concrete curb.

☐ Review  Documentation Required

BEFORE PLAIN CEMENT CONCRETE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review applicable Americans with Disabilities Act (ADA) specifications if the sidewalk includes ADA ramps. If the designer provided the design, the ramps can be found in the contract documents. If the project utilizes design-build ramps, then the drawings will be submitted by the contractor via PPCC .	MCDocs
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review any TIFs and ensure the contractor is in compliance.	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure forms are set to line and grade and the dimensions outlined in PUB 72M RC Standard 64M.	

DURING PLAIN CEMENT CONCRETE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	If excavation is required, document the type of excavation and where the excavated material was hauled.	MCDocs
☐ 	Verify the base material was prepared and compacted.	MCDocs

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☐		Task	Reference
☐		Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐		Ensure the concrete is placed, vibrated, finished, and cured properly.	MCDocs
☐		After forms are removed, verify contraction joints are constructed and curbs are backfilled as soon as possible per PUB 72M RC Standard 64M .	
☐		Ensure that the plain cement concrete curb is backfilled properly.	

AFTER PLAIN CEMENT CONCRETE CURB CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The contractor uses Class A concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan. The concrete must be supplied by an approved supplier and mixed using an approved mix design. All other materials required to complete the curb in the field are outlined in PUB 408 Section 630. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe capable of removing existing curbs, pavement, and sidewalks. Equipment, including a vibratory plate compactor, is needed to compact the base material under the curb. The contractor may use a curb machine capable of placing the curb to the dimensions shown on PUB 72M RC Standard 64M to place the curb. If the curb is constructed with CIP concrete, the contractor also needs equipment to test the concrete and vibrators to consolidate the concrete.

A level is needed to control the grade of the curb.

Mechanical:				
Backhoe	Curb Machine	Vibratory Plate Compactor		

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Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
Concrete Testing Equipment	Smart Level	Survey Transit		

Construction Methods

If necessary, the contractor removes the existing curb, pavement, or sidewalk, forming neat lines. Excess material is hauled to an approved waste area.

The contractor prepares the curb base and sets forms (metal or wood) to the line and grade of the dimensions shown on PUB 72M RC Standard 64M for the type of curb indicated on the plan. Class A concrete is placed in the forms and vibrated properly. Prior to placement, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. After placement, the top surface is troweled smooth, and a broomed finish is applied if necessary.

The contractor may use an acceptable self-propelled curb machine to place the curb. Curb depressions or handicapped access ramp depressions may need to be cast in place if a curb machine is used. After the concrete is placed and finished, curing materials are applied.

After the forms are removed, the contractor installs construction joints and backfills the curb as soon as feasible.

A depressed curb used for driveway aprons requires rebar per PUB 72M RC Standard 64M. If the depressed curb is being installed as part of an ADA ramp, then the curb will need to be placed flush with the existing roadway with a tolerance of ¼ inch. The asphalt along the curb of an ADA ramp should not be sealed after the paving operation.

Measuring & Payment Methods

Plain cement concrete curbs are paid for by the linear foot. This is field-measured and paid on a PSA.

If Class 1 excavation is required, it is paid by the cubic yard. This is also field-measured, with computations and payment shown on a PSA.

20. PLAIN CONCRETE MOUNTABLE CURB (SEC. 633)

This section addresses the construction of a plain concrete mountable curb.

☐ Review  Documentation Required

BEFORE PLAIN CONCRETE MOUNTABLE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure forms are set to line and grade and the dimensions outlined in PUB 72M RC Standard 65M.	

DURING PLAIN CONCRETE MOUNTABLE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	If excavation is required, document the type of excavation and where the excavated material was hauled.	MCDocs
☐ 	Verify the base material was prepared and compacted.	MCDocs
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Ensure the concrete is placed, vibrated, finished, and cured properly.	MCDocs

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☐		Task	Reference
☐		After forms are removed, verify contraction joints are constructed and curbs are backfilled as soon as possible per PUB 72M RC Standard 65M.	
☐		Ensure that the plain concrete mountable curb is backfilled properly.	

AFTER PLAIN CONCRETE MOUNTABLE CURB CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The contractor uses Class A concrete, meeting the requirements of PUB 408 Sections 630 and 704 and the concrete QC plan. The concrete must be supplied by an approved supplier and mixed using an approved mix design. If subbase material is required, it must meet the requirements of PUB 408 Section 350. Other materials required to complete the curb in the field are outlined in PUB 408 Section 633. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe or excavator capable of removing existing curbs, pavement, and sidewalks. Equipment, including a small roller or vibratory plate compactor, is needed to compact the base material under the curb. The contractor may use a self-propelled curb machine capable of placing the curb to the dimensions shown on PUB 72M RC Standard 65M to place the curb. If the curb is constructed with CIP concrete, the contractor also needs equipment to test the concrete and vibrators to consolidate the concrete.

A level is needed to control the grade of the curb.

Mechanical:				
Backhoe	Curb Machine	Excavator	Vibratory Plate Compactor	Vibratory Steel Wheel Roller
Hand Tools:				
Concrete Vibrator				

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Testing/Inspection:				
Concrete Testing Equipment	Smart Level	Survey Transit		

Construction Methods

If necessary, the contractor removes the existing curb, pavement, or sidewalk, forming neat lines. Excess material is hauled to an approved waste area.

The contractor prepares the curb base and sets forms (metal or wood) to the line and grade of the dimensions shown on PUB 72M RC Standard 65M for the type of curb indicated on the plan. Class A concrete is placed in the forms and vibrated properly. Prior to placement, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. After placement, the top surface is troweled smooth, and a broomed finish is applied if necessary.

The contractor may use an acceptable self-propelled curb machine to place the curb. After the concrete is placed and finished, curing materials are applied. After the forms are removed, the contractor backfills the curb as soon as possible.

Measuring & Payment Methods

Plain concrete mountbale curbs are paid for by the linear foot. This is field-measured and paid on a PSA.

If Class 1 excavation is required, it is paid by the cubic yard. This is also field-measured, with computations and payment shown on a PSA.

Subbase placement is incidental to the curb construction.

21. ASPHALT CONCRETE CURB (SEC. 636)

This section addresses the construction of a hot-mixed, hot-laid asphalt curb on a complete asphalt surface.

☐ Review  Documentation Required

BEFORE ASPHALT CONCRETE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING ASPHALT CONCRETE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure a tack coat is applied to the existing pavement before placing the new curb, meeting the requirements of PUB 408 Section 460.	
☐ 	Confirm the temperature of the asphalt material is within the range shown in PUB 408 Section 636.	
☐ 	Verify that the newly placed curb does not show signs of sagging, cracking, or distortion and conforms to the line and grade shown in the plans.	
☐ 	Ensure that the asphalt concrete curb gutter is backfilled properly.	

AFTER ASPHALT CONCRETE CURB CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials used in asphalt concrete curbs must meet all the applicable requirements outlined in PUB 408 Section 636. The contractor submits a mix design for approval before starting any work. The material must be mixed at an approved asphalt mixing plant. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs hand spraying equipment to apply a tack coat before placing the curb; the tack coat application must meet the requirements of PUB 408 Section 460. The contractor also needs an acceptable self-propelled extruding curb paver as well as equipment to haul the hot-mix material from the batch plant to the project site. The hauling equipment should meet the requirements of PUB 408 Section 413.3.

The contractor and inspector need a probe thermometer capable of reading temperatures up to 400F to check the temperature of the asphalt material when it arrives on the project. The temperature of the material must be within the range shown in PUB 408 Section 636.

Mechanical:				
Curb Paver				
Hand Tools:				
Hand Sprayer				
Testing/Inspection:				
Probe Thermometer				

Construction Methods

The asphalt material arrives on the project in acceptable hauling equipment as outlined in PUB 408 Section 413.3. The material is mixed at an approved asphalt batch or drum plant according to the approved mix design. A self-propelled extruding curb paver is used to place the asphalt material. The contractor places the asphalt mixture in the paver hopper without segregation and then extrudes the mixture through the mold to provide the proper compaction and surface texture.

The contractor uses chalk lines or a level and string line to maintain the proper alignment and grade of the completed curb. If placement is interrupted or the temperature of the asphalt material drops below 275F, a vertical joint must be cut in the curb.

When new material is placed next to the vertical joint, the contractor must place a uniform amount of hot asphalt cement as outlined in PUB 408 Section 636.

Measuring & Payment Methods

The asphalt concrete curb is paid for by the linear foot. After completion and acceptance of the curb, it is field measured and paid on a PSA.

22. PLAIN CEMENT CONCRETE GUTTER & CURB GUTTER (SEC. 640 & 641)

This section addresses the construction of a plain cement concrete gutter and a plain cement concrete curb gutter.

Plain Cement Concrete Gutter

A concrete gutter is a concrete component constructed beside pavements. The function of a concrete gutter is to discharge water and prevent it from infiltrating beneath the pavement.

Plain Cement Concrete Curb Gutter

A plain cement concrete curb gutter serves the same purpose as a concrete gutter and includes a concrete curb, which channels the water flow to inlets.

☐ Review  Documentation Required

BEFORE PLAIN CEMENT CONCRETE GUTTER & CURB GUTTER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure forms are set to line and grade and the dimensions outlined in PUB 72M RC Standard 64M.	

DURING PLAIN CEMENT CONCRETE GUTTER & CURB GUTTER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	If excavation is required, document the type of excavation and where the excavated material was hauled.	
☐ 	Verify the foundation area is prepared to the shape and dimensions shown on PUB 72M RC Standard 64M.	

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☐		Task	Reference
☐		Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	
☐		Ensure the concrete is placed, vibrated, finished, and cured properly.	
☐		Ensure that the gutter or curb gutter is backfilled properly.	

AFTER PLAIN CEMENT CONCRETE GUTTER & CURB GUTTER CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The contractor uses Class AA concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan. It must also be supplied from an approved concrete batch plant and mixed using an approved concrete mix design for the class of concrete used. Other materials required to construct concrete gutters and concrete curb gutters should meet the applicable requirements as outlined in PUB 408 Sections 640 and 641. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe, gradall, or excavator to prepare the foundation area as outlined in PUB 408 Section 640. Equipment, including a vibratory plate compactor, is also required to compact the embankment material in the foundation. The contractor may use a curb machine capable of placing the curb to the dimensions shown on PUB 72M RC Standard 64M to place the curb. A generator and small hand tools are necessary to construct forms.

The contractor needs a survey transit to establish grades for the new gutter or curb gutter. Grades are marked on offset stakes and used to control the alignment and grade. Concrete testing equipment is used to test concrete, and concrete vibrators are used to consolidate the concrete.

Mechanical:				
Backhoe	Curb Machine	Excavator	Generator	Gradall
Vibratory Plate Compactor				

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Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
Concrete Testing Equipment	Engineer Ruler	Survey Transit	Tape Measure	

Construction Methods

Using a survey transit, the contractor lays out the gutter and curb gutter and sets finish grades.

The contractor excavates and constructs the foundation as per PUB 408 Section 640. Forms are then constructed to the dimensions shown on PUB 72M RC Standard 64M. After the forms are completed and approved by the inspector, the contractor places Class AA concrete in the forms. Prior to placing the concrete, the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan.

After the concrete is placed, vibrated, and finished, curing is applied. As soon as possible after the forms are removed, the gutter or curb gutter is backfilled.

Measuring & Payment Methods

Gutters and curb gutters are paid for by the square yard. After placement is complete, they are field-measured, with computations and payment shown on PSA.

If Class 1 excavation is required, it is paid by the cubic yard. The excavation is also field measured, with computations and payment shown on PSA.

23. CEMENT CONCRETE PAVING FOR STREAM BEDS (SEC. 667)

This section addresses the construction of reinforced cement concrete paving for stream beds. The paving is usually needed at a drainage structure to prevent erosion of the stream bed under and adjacent to the structure.

☐ Review  Documentation Required

BEFORE CEMENT CONCRETE PAVING FOR STREAM BEDS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify forms and reinforcement are placed to the dimensions shown on the project plan and meet the requirements of PUB 408 Section 667 and PUB 72M RC Standard 40M.	

DURING CEMENT CONCRETE PAVING FOR STREAM BEDS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that the contractor excavated for the placement of concrete pavement to the grades shown on the project plan.	MCDocs
☐ 	Confirm that excess excavated material is hauled to an approved waste area.	MCDocs
☐ 	Verify the foundation area was prepared, compacted, and approved by the IIC for the placement of forms.	MCDocs
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs

Section 600: Incidental Construction

☐		Task	Reference
☐		Ensure construction joints are constructed and sealed as outlined in PUB 408 Section 667 and PUB 72M RC Standard 21M.	

AFTER CEMENT CONCRETE PAVING FOR STREAM BEDS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The contractor uses Class A cement concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan, to construct the cement concrete paved stream bed. The concrete must be from an approved concrete batch plant and batched from an approved mix design. The reinforcement used in the concrete must meet the requirements of PUB 408 Section 709 and PUB 72M RC Standard 21M. Other materials used to construct the paved stream bed must meet the applicable requirements of PUB 408 Section 667. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as an excavator, backhoe, gradall, or front end loader to excavate the stream bed to the required depth. A dump truck is used to haul excess excavated material to an approved waste area.

Equipment such as a vibratory plate compactor, walk-behind roller, or vibratory steel wheel roller is needed to compact the foundation. The contractor also needs a concrete saw to construct contraction joints per PUB 408 Section 667 and PUB 72M RC Standard 21M and a concrete vibrator to consolidate the concrete.

A survey transit is required to lay out and set the grade for the concrete paving. The contractor also needs concrete testing equipment meeting the requirements of PUB 408 Section 704 to test the concrete placed in the stream bed.

Mechanical:				
Backhoe	Concrete Saw	Dump Truck	Excavator	Front End Loader
Gradall	Vibratory Plate Compactor	Vibratory Steel Wheel Roller	Walk-Behind Roller	

Section 600: Incidental Construction

Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
Concrete Testing Equipment	Survey Transit			

Construction Methods

The contractor lays out the limits of excavation for the paving and sets grade stakes to control the finished grade and alignment. The contractor then excavates to subgrade and hauls excess excavated material to an approved waste area. The foundation area is prepared, and forms and reinforcement are placed according to PUB 72M RC Standards 21M and 40M.

Forms and reinforcement are placed, and the inspector approves them for concrete placement. Prior to placing concrete, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. After the concrete is placed, it is vibrated and cured. Refer to PUB 408 Section 711 for curing requirements. As soon as possible after placing the concrete, the contractor saws the contraction joints per PUB 408 Section 667.

Measuring & Payment Methods

Cement concrete paving for stream beds and excavation is paid for by the cubic yard. The paving and excavation are field measured, with computations and payment shown on a PSA. Payment for exceeded plan width cannot be made unless authorized by the Department.

24. RIGHT-OF-WAY FENCE (SEC. 624)

This section addresses the construction of Type 1, Type 2, and Type 5 right-of-way (ROW) fences placed to control access to a highway.

☐ Review  Documentation Required

BEFORE ROW FENCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING ROW FENCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	After installation, confirm the fence is checked to ensure there are no depressions greater than 3 inches under the fence.	MCDocs
☐ 	Verify that fence and posts are installed in accordance with PUB 408 Section 624 and PUB 72M RC Standard 60M.	

AFTER ROW FENCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 600: Incidental Construction

☐		Task	Reference
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The materials used to fabricate a ROW fence, post, and all hardware, as well as galvanizing, are outlined in PUB 408 Section 1110. The contractor may use Class A cement concrete for the footing of end posts, corner posts, pull posts, and braces. The concrete should meet the requirements of PUB 408 Section 704 and the concrete QC plan. The contractor must also have the appropriate concrete testing equipment.

The contractor may need ground rods and ground wires to ground the fence if it crosses under an electrical transmission line (the ground is placed directly under the electrical lines). If so, these materials must meet the requirements of PUB 408 Section 624. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

A ROW fence is usually constructed using hand tools, including a manually operated post driver to install the fence posts. A sledgehammer is used to drive anchor rods. Often, the contractor uses air-actuated tools, requiring an air compressor. Shovels and a fence stretcher are used to tighten the fence during erection.

The contractor may have to clear and grub the ROW line before erecting the fence. If this is required, chainsaws are used to cut trees. Excavating equipment such as a bulldozer, track front loader, or excavator is used to remove stumps and create a reasonably smooth ground profile at the fence line.

The contractor needs a survey transit to lay out the ROW fence line. If the contractor constructs concrete post anchors instead of drive anchors, concrete testing equipment meeting the requirements of PUB 408 Section 704 is needed.

Mechanical:				
Air Compressor	Bulldozer	Excavator	Power Post Driver	Track Front Loader
Hand Tools:				
Chainsaw	Concrete Vibrator	Fence Stretcher	Shovel	Sledgehammer
Testing/Inspection:				
Concrete Testing Equipment	Survey Transit			

Construction Methods

Prior to any concrete work, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

Using a survey transit, the contractor lays out the ROW fence line. If required, the contractor clears and grubs the ROW line to ensure it is clear and has a reasonably smooth ground profile. The contractor then lays out the post locations per PUB 72M RC Standard 60M for the type of ROW fence indicated. Posts are then driven, anchors are excavated, concrete is placed for post anchors (if required), and the fence is installed per PUB 408 Section 624 and PUB 72M RC Standard 60M for the type of ROW fence indicated.

Measuring & Payment Methods

The ROW fence is paid for by the linear foot, which includes the line post and all hardware to install the fence. This is a field measured and paid on a PSA.

End posts, corner posts, pull posts, and gates are paid each, using the quantity of each. These are counted after they are installed and paid each on a PSA. The contract drawings and PUB 72M RC Standard 60M show where each type of post is required.

If Class 2 excavation is needed to smooth the profile of the ground per specifications, it is paid in cubic yards, if directed by the Department Representative, and greater than 6 inches (lesser amounts are incidental to the work). Class 2 excavations are field measured, with computations and payment shown on a PSA. Check with the IIC regarding Class 2 excavation for the ROW fence.

25. CONCRETE SLOPE WALL (SEC. 673)

This section addresses the construction of a pre-cast cement concrete block wall and a CIP cement concrete slab slope wall.

Pre-cast Cement Concrete Block Wall

A pre-cast concrete block wall is fabricated at a pre-cast facility and may include lifting devices to help set it into place. It serves the same purpose as a CIP concrete slope wall.

CIP Cement Concrete Slope Wall

A concrete slope wall is designed to prevent soil erosion on a slope, typically under a bridge structure.

☐ Review  Documentation Required

BEFORE CONCRETE SLOPE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify the type of slope wall constructed and the location.	MCDocs
☐ 	Ensure pre-cast units are checked on arrival to ensure that an inspector at the fabricator has stamped them and that they are stamped with the proper information.	MCDocs
☐ 	Ensure pre-cast units are checked for damage, such as cracks and spalls.	MCDocs
☐ 	Ensure forms and reinforcement bars are approved for placement in concrete.	MCDocs

DURING CONCRETE SLOPE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 600: Incidental Construction

☐		Task	Reference
☐		Verify the foundation area is prepared to grade per PUB 408 Section 673 and PUB 219M BC Standard 731M.	
☐		Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐		Verify the pre-cast blocks are placed per PUB 408 Section 673 and PUB 219M BC Standard 731M.	
☐		If CIP concrete is used, verify the forms and reinforcement are placed according to PUB 408 Section 673 and PUB 219M BC Standard 731M.	
☐		If a CIP slope wall is used, verify that the concrete slabs do not exceed 16 feet in length or width as referenced in PUB 408 Section 673.	

AFTER CONCRETE SLOPE WALL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The primary material used to construct concrete slope walls is Class A concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan. The concrete must be produced by an approved supplier and batched from an approved mix design. If pre-cast blocks are used, they must also be from an approved supplier and meet the requirements of PUB 408 Section 713.

Prior to block or concrete placement, Class 4 Type A geotextile is installed according to the requirements of PUB 408 Section 673. Reinforcement used in the concrete must meet the requirements of PUB 408 Section 709. Other materials used to construct slope walls must meet the applicable requirements outlined in PUB 408 Section 673. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs excavating equipment such as an excavator, backhoe, gradall, or front end loader to prepare the foundation area, as shown on PUB 219M BC Standard 731M.

The contractor also needs a survey transit to lay out and establish grades for the slope wall. Established grades are marked on offset stakes and used to control the grade and alignment of the slope wall.

Section 600: Incidental Construction

The contractor also needs concrete testing equipment, meeting the requirements of PUB 408 Section 704, to test the concrete placed in the slope wall, as well as a concrete vibrator to consolidate the concrete.

Mechanical:				
Backhoe	Excavator	Front End Loader	Gradall	
Hand Tools:				
Concrete Vibrator				
Testing/Inspection:				
Concrete Testing Equipment	Survey Transit			

Construction Methods

The contractor lays out and establishes finish grades, marked on offset stakes, to control the grade and alignment of the slope wall construction. The foundation area is prepared, as outlined in PUB 408 Section 673 and PUB 219M BC Standard 731M, including the placement of Class 4 Type A geotextile and sand.

If pre-cast blocks are used, they are placed per PUB 408 Section 673 and PUB 219M BC Standard 731M. If a CIP slope wall is constructed, the contractor sets the forms and places the reinforcement; this operation must be approved by the inspector prior to concrete placement. The contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. The contractor then places, vibrates, and cures the concrete.

All joints in the concrete are constructed as outlined in PUB 408 Section 673 and PUB 219M BC Standard 731M. Concrete slabs formed in the CIP slope wall cannot be more than 16 feet in length or width unless directed for closures.

Measuring & Payment Methods

Pre-cast cement concrete blocks and CIP slope walls are paid for by the square yard. After completion, they are field-measured, with computations and payments shown on a PSA.

26. BRICK MASONRY (SEC. 663)

This section addresses the construction of brick masonry.

☐ Review  Documentation Required

BEFORE BRICK MASONRY CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify the type of masonry structure constructed.	MCDocs
☐ 	Ensure forms and foundation for placement of concrete have been approved.	MCDocs

DURING BRICK MASONRY CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify footers are excavated and constructed as detailed in the project plan and meet the requirements of PUB 408 Section 663.	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Ensure that the contractor constructs a masonry sample on site, placed per PUB 408 Section 663.	
☐ 	Verify bricks are placed, pointed, and cured to the requirements of PUB 408 Section 663.	

AFTER BRICK MASONRY CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The brick used for the masonry must meet the requirements of PUB 408 Section 713. The mortar must meet the requirements of PUB 408 Section 705. Class A concrete used for the footer of the structure must meet the requirements of PUB 408 Section 704 and the concrete QC plan. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe, gradall, or excavator to excavate for the masonry structure footer. Equipment such as a vibratory plate compactor is required to compact the bottom of the footer excavation.

The contractor needs a survey transit to set grades for the masonry structure, as well as a smart level and string line level to keep the brick courses level.

The concrete testing equipment used to test the concrete placed in masonry footers must meet the requirements of PUB 408 Section 704.

Mechanical:				
Backhoe	Excavator	Gradall	Vibratory Plate Compactor	
Hand Tools:				
Concrete Vibrator	String Line			
Testing/Inspection:				
Concrete Testing Equipment	Smart Level	Survey Transit		

Construction Methods

The contractor constructs a masonry sample on site, placed as outlined in PUB 408 Section 663.

Using a survey transit, the contractor lays out and sets grades for the masonry structure and then excavates the foundation area to the required dimensions. The bottom of the excavation is compacted to ensure it is firm and even.

Section 600: Incidental Construction

The contractor then sets the forms to the dimensions required and to grade. After an inspector approves the forms, the contractor places Class A concrete in the forms. Prior to placing the concrete, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

After the concrete is placed and finished, it is cured per PUB 408 Section 704. After the concrete has cured for at least 12 hours, the contractor constructs the masonry structure to the required dimensions and grade.

Measuring & Payment Methods

Brick masonry, Class A concrete, and excavation for the class indicated are paid by the cubic yard. These items are field-measured, with computations and payments shown on a PSA.

27. MODULAR ARCHITECTURAL BLOCK SYSTEM (SEC. 664)

This section addresses the construction of a modular architectural block system. This system may be used for a nonstructural landscaping architectural application, according to the manufacturer's recommendation.

☐ Review  Documentation Required

BEFORE MODULAR ARCHITECTURAL BLOCK SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Ensure the contractor is certified by the manufacturer to install the block system. If the contractor is not certified, a trained technician from the block manufacturer is on site.	MCDocs
☐ 	Confirm the type of modular architectural block system used and the location placed.	MCDocs
☐ 	Verify the blocks were made and erected per the approved shop drawings and PUB 408 Section 664.	MCDocs
☐ 	Ensure the blocks are inspected for defects when they arrive on the project per PUB 408 Section 664.	MCDocs

DURING MODULAR ARCHITECTURAL BLOCK SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

AFTER MODULAR ARCHITECTURAL BLOCK SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The modular architectural blocks and all the materials required to install the blocks are outlined in PUB 408 Section 664. All materials must meet all the applicable requirements of PUB 408 Section 664. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor submits shop drawings of the blocks for approval prior to placement. The blocks must meet the requirements of the shop drawings and the requirements of PUB 408 Section 664. Blocks are rejected if they have defects that indicate imperfect portioning, mixing, or molding; non-uniform or contrasting coloration; surface defects such as honeycombing; or areas damaged beyond repair.

The contractor needs equipment such as an excavator, backhoe, or gradall to excavate as required to place the block system. The contractor also needs a front end loader, gradall, or excavator to place an 8-inch-thick aggregate base per PUB 408 Section 664 and shop drawings. A vibratory plate is used to compact the coarse aggregate backfill as outlined in PUB 408 Section 664.

The contractor uses a survey transit to lay out and set grades for the architectural block system. The contractor also needs a level to control the block course.

Mechanical:				
Backhoe	Excavator	Front End Loader	Gradall	Vibratory Plate Compactor
Testing/Inspection:				
Smart Level	Survey Transit			

Construction Methods

The contractor lays out the location of the modular architectural block system. The contractor then excavates the work area, places Class 4 Type A geotextile, constructs a level 8-inch base, and places the block system per the shop drawings. The block system is then backfilled.

The contractor must be familiar with the installation of the block system and be certified by the manufacturer. If the contractor is not certified, a trained technician from the block manufacturer must be on site.

Measuring & Payment Methods

The modular architectural block system is paid by the square foot. The system is field measured on the vertical face of the blocks (including the vertical face concealed by the finish grade), with computations and payment shown on a PSA.

Excavation is incidental to this item.

28. STONE SLOPE WALL (SEC. 674)

This section addresses the construction of a stone slope wall or a mortared stone sloped wall. A stone slope wall is designed to prevent soil erosion on a slope, typically under a bridge structure.

☐ Review  Documentation Required

BEFORE STONE SLOPE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Confirm the area of the stone wall placement is prepared per the plan drawings and PUB 72M RC Standard 40M.	

DURING STONE SLOPE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Ensure that mortar, if required, is mixed, and meets the requirements of PUB 408 Section 705.	MCDocs
☐ 	If the mortar is used for a mortared stone slope wall, verify how the mortar is mixed, placed, and cured as specified in PUB 408 Section 674.	MCDocs
☐ 	Ensure that mortar is not placed in freezing weather unless permitted and adequate protection is available.	MCDocs
☐ 	Ensure the stone is placed and mortared as specified in PUB 408 Section 674.	

Section 600: Incidental Construction

☐		Task	Reference
☐		Verify that the stone is placed as specified in PUB 408 Section 674 and that Class 4 Type A geotextile was placed per specifications.	
☐		If concrete toe walls, cut-off walls, and anchor walls are constructed, verify how the concrete is placed, vibrated, and cured, as referenced in PUB 408 Section 675.	

AFTER STONE SLOPE WALL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The stone used for the stone slope wall must meet the requirements specified in PUB 408 Section 674. If the plan drawings show a concrete toe wall, the concrete must meet all the requirements for Class A concrete specified in PUB 408 Section 704 and the concrete QC plan.

Class 4 Type A geotextile is used per PUB 408 Section 674 and PUB 72M RC Standard 40M; the geotextile must also meet all the requirements in PUB 408 Section 735. Other materials required to construct the stone slope wall must meet the applicable requirements listed in PUB 408 Section 674. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as a backhoe, gradall, or excavator to prepare the foundation area, including excavating for anchor walls and a toe wall. The contractor may need a portable mixer to mix mortar if a mortared stone slope wall is to be placed. The mortar may be premixed and delivered from an approved concrete batch plant in a concrete mixer.

The contractor needs a survey transit to lay out and set grades for the stone slope wall. If concrete is used, the contractor needs concrete testing equipment meeting the requirements of PUB 408 Section 704.

Mechanical:				
Backhoe	Concrete Mixer	Excavator	Gradall	
Hand Tools:				
Concrete Vibrator				

Section 600: Incidental Construction

Testing/Inspection:				
Concrete Testing Equipment	Survey Transit			

Construction Methods

The contractor lays out the area of the stone slope wall and prepares the location to grade as specified on the plan. If required by plan drawings, anchor walls, cut-off walls, and a toe wall are excavated, forms are constructed, and reinforcement is placed and approved by the inspector prior to concrete placement. In addition, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan. Class 4 Type A geotextile is then placed as specified on PUB 72M RC Standard 40M.

The depth of the stone placement is shown on the plan drawings. Stone meeting the specifications is hand-placed as specified in PUB 72M RC Standard 40M. If a mortared stone slope wall is used, the contractor places the stone and mortar as specified in PUB 408 Section 674. After placement, the mortar is cured with water for at least three days.

Measuring & Payment Methods

Stone slope walls and mortared stone slope walls are paid for by the cubic yard after completion. The walls are field measured, with computations and payment shown on a PSA.

29. RANDOM STONE SLOPE WALL (SEC. 675)

This section addresses the construction of a random stone slope wall. Typically, a random stone slope wall is constructed on the slope of a bridge.

☐ Review  Documentation Required

BEFORE RANDOM STONE SLOPE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations if a CIP concrete placement is required.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify the type of random stone slope wall placed and its location.	MCDocs
☐ 	Confirm the slope wall is laid out per the project plan and PUB 219M BC Standard 781M.	
☐ 	Ensure the foundation area is excavated to plan grades and per PUB 219M BC Standard 781M.	
☐ 	Ensure that forms and reinforcement for the toe wall, anchor wall, and cut-off wall are placed as outlined in PUB 219M BC Standard 781M.	

DURING RANDOM STONE SLOPE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the contractor's certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan and that test results are within the specified limits.	MCDocs
☐ 	Ensure toe walls, anchor walls, and cut-off walls are constructed to the specifications of PUB 219M BC Standard 781M.	MCDocs

Section 600: Incidental Construction

☐		Task	Reference
☐		Verify the geotextile is placed and fastened as specified in PUB 408 Section 212.	MCDocs

AFTER RANDOM STONE SLOPE WALL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The coarse aggregate used for a random stone slope wall is Type A No. 1 stone, meeting the requirements of PUB 408 Section 703. Class A concrete, meeting the requirements of PUB 408 Section 704 and the concrete QC plan, is used for toe walls, anchor walls, and cut-off walls. Other materials used to construct random stone slope walls must meet the applicable requirements listed in PUB 408 Section 675. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs equipment such as an excavator, backhoe, or gradall to prepare the foundation area as specified on PUB 219M BC Standard 781M and to the grade shown on the design plans. The contractor may need hauling equipment, including a dump truck, to haul excess excavated material to an approved waste area.

The contractor needs a survey transit to lay out and set finish grades for the wall. Finish grades are marked on the offset stakes.

The contractor also needs concrete testing equipment to test the concrete that is placed in the toe, anchor, and cut-off walls as specified in PUB 408 Section 704 and the concrete QC plan, as well as a vibrator to consolidate the concrete.

Mechanical:				
Backhoe	Dump Truck	Excavator	Gradall	
Hand Tools:				
Concrete Vibrator				

Section 600: Incidental Construction

Testing/Inspection:				
Concrete Testing Equipment	Survey Transit			

Construction Methods

The contractor uses a survey transit to lay out the placement area of the wall as indicated in the plan. Finish grades are marked on the offset stakes used to control the grade and alignment of the slope wall. The contractor then excavates to the indicated elevation shown on the project plan and the requirements of PUB 219M BC Standard 781M. Excess excavated material is hauled to an approved waste area.

The contractor places forms and reinforcement for the construction of the toe wall and the cut-off wall per PUB 219M BC Standard 781M. The inspector checks the forms and reinforcement to ensure they meet the requirements of PUB 219M BC Standard 781M and approves them for placement of concrete. Prior to placement, the contractor's certified concrete technician tests the concrete in accordance with the specifications and the concrete QC plan.

The concrete is placed, vibrated, and cured. Class 4 Type A Geotextile and aggregate of the type and size indicated on the project plan are placed as per PUB 219M BC Standard 781M and PUB 408 Section 675.

Measuring & Payment Methods

Random stone slope walls are paid for by the cubic yard. The walls are field measured, including toe, anchor, and cut-off walls, with computations and payment shown on a PSA.

30. GABIONS (SEC. 626)

This section addresses the furnishing, assembling, and filling of open wire mesh baskets with aggregates to form gabions. Gabions are used for channel lining, slope walls, and channel deflectors to eliminate erosion.

☐ Review  Documentation Required

BEFORE GABIONS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING GABIONS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the contractor sets grades to control the alignment and finish grade of the gabions.	MCDocs
☐ 	Verify wire mesh baskets are assembled per PUB 408 Section 626 and PUB 72M RC Standard 43M.	
☐ 	Verify the aggregate used to fill the baskets meets the requirements of PUB 408 Section 626 and is from an approved supplier listed in PUB 34 Bulletin 14.	
☐ 	Verify the geotextile is placed per PUB 72M RC Standard 43M and PUB 408 Section 212.	
☐ 	Confirm compaction and finish of gabion foundation is checked.	MCDocs
☐ 	There is no nuclear density compaction requirement, but the inspector should inspect the compacted foundation to make sure it is able to support the baskets. Document compaction on Form TR-478A and attach to PSA.	

AFTER GABION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The wire mesh used to construct gabion baskets must meet the requirements of PUB 408 Section 626 for the type indicated. The aggregate used to fill the baskets must also meet the requirements of PUB 408 Section 626 and be furnished by an approved supplier listed in PUB 34 Bulletin 14. Class 4 Type A geotextile material is used per PUB 72M RC Standard 43M and must meet the requirements of PUB 408 Sections 212 and 735. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

A survey transit is used to set grades for the placement of gabion baskets.

The contractor needs equipment such as an excavator, gradall, or a track front loader capable of excavating material to the required depth for the type of gabion being placed. Dump trucks are needed to haul the excess excavated material to an approved waste area. The contractor also needs equipment such as a roller or vibratory plate compactor to compact the entire foundation area where gabion baskets are to be placed.

If Type B gabions are installed, the contractor can use small power equipment, such as a backhoe or a small front end loader, to place the aggregate in the gabion baskets.

Mechanical:				
Backhoe	Dump Truck	Excavator	Gradall	Track Front Loader
Vibratory Plate Compactor	Vibratory Steel Wheel Roller			
Testing/Inspection:				
Survey Transit				

Construction Methods

Using a survey transit, the contractor sets finish grades on offset stakes and excavates the foundation to the required depth. After the foundation is excavated, it is compacted with a roller or vibratory plate compactor to a smooth, firm, even surface free of debris.

After compaction, the contractor places Class 4 Type A geotextile. The gabion baskets are then assembled and set to line and grade. A description for assembling the baskets can be found in PUB 408 Section 626. Contractors must also follow the manufacturer's recommendations. If Type A gabions are indicated, aggregate is placed by hand (at least along the exposed faces). Type B gabions can be filled using small power equipment. After the gabion baskets are filled with aggregate, the lids are secured.

Measuring & Payment Methods

Gabions are paid by the cubic yard. They are field-measured, with computations and payments shown on a PSA.

31. RUMBLE STRIPS (SEC. 660)

This section addresses the construction of rumble strips on asphalt and concrete shoulders.

☐ Review  Documentation Required

BEFORE RUMBLE STRIPS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	
☐ 	Verify that the required minimum shoulder widths exist in order to install rumble strips.	MCDocs

DURING RUMBLE STRIPS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	If damage to the shoulder occurs, verify that it is appropriately repaired.	MCDocs
☐ 	Ensure a guide is used on the milling machine to control alignment.	MCDocs
☐ 	Verify rumble strips are milled at the offset from pavement joints as shown on PUB 72M RC Standard 22M.	
☐ 	For asphalt pavements, confirm that rumble strips are to be installed prior to the placement of the final permanent pavement markings and prior to the placement of the longitudinal joint sealing. For concrete pavements only construct after curing, as specified in PUB 408 Section 501.3.	MCDocs
☐ 	Verify rumble strips are milled to the dimensions shown on PUB 72M RC Standard 22M.	
☐ 	Ensure debris left from milling is cleaned up and hauled to an approved waste area.	MCDocs

AFTER GABION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The contractor needs a milling machine capable of providing a smooth cut without tearing and snagging the asphalt or concrete and capable of producing rumble strips, as shown on PUB 72M RC Standard 22M. The machine should be equipped with guides to provide uniformity and consistency in the alignment of each cut with respect to the roadway.

The contractor also needs equipment such as a power broom, a front end loader, and a dump truck to clear and remove grinding debris from the shoulder after milling.

The inspector needs a measuring tape or engineer ruler to check the dimensions of the milled rumble strips to ensure that they meet the requirements of PUB 72M RC Standard 22M.

Mechanical:				
Dump Truck	Front End Loader	Milling Machine	Power Broom	
Testing/Inspection:				
Engineer Ruler	Tape Measure			

Construction Methods

Using a milling machine capable of providing rumble strips, as shown in PUB 72M RC Standard 22M, the contractor mills the rumble strips at the planned locations. After the rumble strips are milled, the contractor sweeps the shoulder with a power broom. The debris is loaded into a dump truck and hauled to an approved waste area.

Measuring & Payment Methods

Concrete and asphalt rumble strips are paid for by the linear foot. These items are field-measured after completion and paid on a PSA.

32. SELECTED MATERIAL SURFACING (SEC. 677)

This section addresses the finishing and placement of a selected material in a prepared area.

☐ Review  Documentation Required

BEFORE SELECTED MATERIAL SURFACING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING SELECTED MATERIAL SURFACING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the foundation area and the aggregate base was prepared per PUB 408 Section 677.	
☐ 	Accept the subbase compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐ 	Verify the aggregate is placed uniformly to the indicated depth and grade without segregation while ensuring it is compacted properly and documented.	MCDocs

AFTER SELECTED MATERIAL SURFACING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The coarse aggregate used is job-specific and must meet the requirements of the type indicated in PUB 408 Section 703. The aggregate must also be furnished by the supplier listed on the contractor's approved source of supply.

The contractor needs a spreader box to place the aggregate and may use a gradall to grade the aggregate. Compaction equipment, meeting the requirements of PUB 408 Section 108, is used to compact the aggregate.

The contractor also needs a survey transit to lay out and set grades for material placement.

Mechanical:				
Gradall	Spreader Box	Vibratory Steel Wheel Roller		
Testing/Inspection:				
Survey Transit				

Construction Methods

The base is prepared as indicated and approved by the inspector. The contractor then spreads the aggregate uniformly on the prepared base, without segregation of coarse and fine material, to the required depth and grade. After the aggregate is placed, it is compacted with a roller, meeting the requirements of PUB 408 Section 108. The aggregate is compacted to visual non-movement under compaction equipment and approved by the inspector.

Measuring & Payment Methods

Selected material surfacing is paid for by the cubic yard or ton. If paid by the cubic yard, the material is field measured, with computations and payment made on a PSA. Areas where material was placed beyond plan widths cannot be paid unless authorized by the Department.

If the aggregate is paid by the ton, payment is based on the quantity incorporated into the work, as shown on the delivery ticket.

33. SLAB STABILIZATION (SEC. 679)

This section addresses the filling of voids beneath existing rigid base courses of pavement.

☐ Review  Documentation Required

BEFORE SLAB STABILIZATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING SLAB STABILIZATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify deflection tests are performed per PUB 408 Section 679 and PUB 72M RC Standard 26M.	
☐ 	Witness the deflection tests.	MCDocs
☐ 	Identify which joints and cracks require stabilization.	MCDocs
☐ 	Verify holes are drilled per PUB 408 Section 679 and PUB 72M RC Standard 26M.	
☐ 	Ensure the grout plant meets the requirements of PUB 408 Section 679.	
☐ 	Verify grout is mixed according to the approved mix design.	MCDocs
☐ 	Ensure the flowability of the grout is checked twice a day using the procedures of ASTM C-939 to ensure it meets the requirements shown on the mix design.	
☐ 	Ensure that when pumping grout, the maximum pressure of 200 lbs. per square inch is not exceeded, and the existing pavement is	

Section 600: Incidental Construction

☐		Task	Reference
		monitored for vertical movement in reference to PUB 408 Section 679.	
☐		Verify the grout was pumped and the pavement was monitored for vertical movement per PUB 408 Section 679.	
☐		Verify the retest of the joints and cracks after 24 hours, and that the results of the retest are in compliance with PUB 72M RC Standard 26M.	

AFTER SLAB STABILIZATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The materials required to do this work must meet the applicable requirements listed in PUB 408 Section 679. In addition, the contractor must submit a grout mix design to the department for approval prior to starting work. All material used must be from the suppliers listed on the contractor's approved source of supply.

The contractor is required to perform testing in accordance with ASTM D-4695 on the existing pavement as specified in PUB 408 Section 679. An 18,000-pound single-axle vehicle is used along with the required deflection gauges. In addition, a grout plant (meeting the requirements of PUB 408 Section 679) and a water truck to supply water to the grout pump are needed. The contractor also needs a drill capable of drilling the grout holes through the pavement and base material, such as a core drill and diamond-tipped core barrels. Vertical movement testing equipment is necessary to measure slab lift.

The contractor needs deflection gauges capable of detecting slab movement to within 0.001 inches for deflection testing as outlined in PUB 408 Section 679.

Mechanical:				
18,000 Pound Single-Axle Vehicle	Core Drill	Grout Plant	Water Truck	
Testing/Inspection:				
Deflection Gauges	Smart Level			

Construction Methods

The contractor, along with the inspector, performs a deflection test on joints and cracks as directed. The test is performed per PUB 408 Section 679. The inspector advises the contractor on which joints and cracks require stabilization, as determined by the deflection test results.

Grout holes are drilled per PUB 72M RC Standard 26M or as directed. The grout is mixed in the grout plant using the proportions shown on the approved mix design. Gauges meeting the requirements of PUB 408 Section 679 are placed on the existing pavement to monitor the lift. The contractor pumps grout into the grout holes, not exceeding a maximum pressure of 200 lbs. per square inch or until the grout comes out of another hole. After completion, the drilled holes are filled with non-shrink grout. The pavement areas that were stabilized are closed to traffic for a minimum of 12 hours. Twenty-four hours after grouting, the stabilized joints or cracks are re-tested.

Measuring & Payment Methods

The deflection test is paid individually, using the quantity of each as completed on a PSA.

Drill holes (including patching with non-shrink grout) are also paid as each. They are field-counted and paid on a PSA.

Grout material is paid for by the bag of cement. Asphalt is paid by the gallon. Polyurethane is paid by the pound. The department will not pay for wasted grout material.

34. SLAB JACKING (SEC. 681)

This section addresses filling voids beneath existing rigid base courses or pavements and pressure jacking the pavement or base course with cement grout to grade.

☐ Review  Documentation Required

BEFORE SLAB JACKING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING SLAB JACKING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify the grout holes were laid out and drilled per PUB 72M RC Standard 26M or as directed.	
☐ 	Verify the grout was mixed according to the approved mix design and pumped per the requirements of PUB 408 Section 681.	
☐ 	Ensure a flow test on the grout is performed at least twice a day per ASTM C-939 specifications.	
☐ 	Ensure the pavement was jacked to the required elevation and did not exceed the limits shown in PUB 408 Section 681.	

AFTER SLAB JACKING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The grout used in slab jacking must meet the requirements of PUB 408 Sections 681 and 679. The contractor submits a grout mix design meeting the requirements outlined in PUB 408 Sections 679 and 681 for approval prior to performing any work. The grout is mixed as outlined in the approved mix design.

The contractor needs a core drill to drill grout holes through the existing pavement that is to be jacked. Hole patterns are set up per PUB 72M RC Standard 26M or as directed.

A grout plant meeting the requirements of PUB 408 Section 679 is used to mix and pump the jack grout. A water tanker is necessary for supplying water to the grout plant.

The contractor needs a survey transit to set grades on the offset stakes that will be used for the jacking operation. The existing pavement is jacked to these finish grades.

Mechanical:				
Core Drill	Grout Plant	Water Truck		
Testing/Inspection:				
Survey Transit				

Construction Methods

The contractor submits a grout mix design for approval prior to performing any work.

The contractor uses a survey transit to set finish grades, which are marked on offset stakes. A level and string line are stretched between the stakes to control the slab jacking. Drill holes are laid out per PUB 72M RC Standard 26M or as directed.

The contractor drills the holes and mixes the grout in a grout plant according to the approved mix design. The grout is pumped into the holes as required to jack the pavement to the finish grade as outlined in PUB 408 Section 681. After grouting is completed, the grout holes are filled with nonshrink grout, as specified in PUB 408 Section 679.

Measuring & Payment Methods

The drill holes are paid as each, counted in the field, and paid on a PSA.

Grout material is paid according to the number of bags of grout incorporated into the work. No payment is made for wasted grout.

35. WATERPROOFING (SEC. 680)

This section addresses the furnishing and placing of adhesive preformed membrane waterproofing systems on concrete or other surfaces.

☐ Review  Documentation Required

BEFORE WATERPROOFING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review types and quantities of various equipment for operation in PUB 408 Section 108.	

DURING WATERPOOFING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the surface was prepared per PUB 408 Section 680, PUB 219M BC Standard 788M, and the manufacturer's recommendation for the type indicated.	
☐ 	Verify that a manufacturer's technical representative is on-site during the waterproofing application or that the system is installed by a factory-trained licensed installer.	MCDocs
☐ 	If the waterproofing is placed on a bridge deck, ensure the leveling asphalt course and the surface asphalt course are placed per PUB 408 Section 680 and PUB 219M BC Standard 788M.	
☐ 	Verify the type and the location of the placed waterproofing system.	MCDocs

AFTER WATERPOOFING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The type of waterproofing system is usually specified in the project plan. If the waterproofing system is not specified on the plan, the contractor submits the waterproofing system listed in PUB 35 Bulletin 15 for approval. All material must meet the requirements of the type indicated and the requirements of PUB 408 Section 680. All materials used must be from the suppliers listed on the contractor's approved material source of supply.

The contractor needs a power broom to clean the surface of the pavement before placing the waterproofing on a horizontal surface. If the membrane is to be placed on a bridge deck, the contractor needs an asphalt paver to place the leveling coarse and the asphalt overlay, as shown on PUB 219M BC Standard 788M.

Compaction requires a pneumatic tire roller and a tandem steel wheel roller, which must meet the requirements of PUB 408 Section 108. The pneumatic tire roller is used to compact the leveling coarse, while the tandem steel wheel roller is used to compact the surface course. The contractor also needs a core drill to drill drain holes, as shown in PUB 219M BC Standard 788M.

The contractor and the inspector need a probe thermometer capable of reading temperatures to 400F. This device is used to check the temperature of the asphalt material when it arrives on the project to ensure it meets the requirements of applicable sections of PUB 408 for the type of material being placed.

Mechanical:				
Asphalt Paver	Core Drill	Pneumatic Tire Roller	Power Broom	Tandem Steel Wheel Roller
Testing/Inspection:				
Probe Thermometer				

Construction Methods

A trained manufacturer's technical representative or factory-trained licensed installer must be present during every phase of the application.

The contractor prepares the surface to be waterproofed per PUB 408 Section 680, PUB 219M BC Standard 788M, and the manufacturer's recommendations. If required, the surface is conditioned and primed according to the manufacturer's recommendations.

The membrane is installed and protected as outlined in PUB 408 Section 680 and PUB 219M BC Standard 788M.

Measuring & Payment Methods

Waterproofing systems are paid for by the square yard. These areas are field-measured after completion, with computations and payments made on a PSA.

REFERENCES

Approved Asphalt Mix Designs Source of Supply – [ECMS](#)

Approved Concrete Quality Control Plan – [PPCC](#)

Approved Pipe Lifting Plan – [PPCC](#)

Approved Quality Control Plan – [PPCC](#)

[CS-6](#) Pipe Installation Inspection Form

[CS-601](#) Post Installation Pipe Inspection Report Form

[CS-4401](#) Curb Ramp Inspection Form

[PUB 2](#) Project Office Manual

- Part A, Section 2 Pre-Bid
- Part C, Section 6 Incidental Construction (600)
- Appendix A, Soil and Earthwork (Report on Compaction Density Non-Movement Form TR-478A)
- Appendix A, Material Forms (Optimum-Rolling Pattern for Asphalt Density Acceptance by Nuclear Method TR-4276B)

[PUB 19](#) Field and Laboratory Testing Manual

- PTM 450 (Final Inspection of 100 Year Design Life Pipe Installations)

[PUB 34](#) Aggregate Producers (Bulletin 14)

[PUB 35](#) Qualified Products List for Construction (Bulletin 15)

[PUB 72M](#) Roadway Construction Standards

- RC Standard 21M (Reinforced Concrete Pavement)
- RC Standard 22M (Rumble Strips)
- RC Standard 26M (Concrete Pavement Rehabilitation (Single Lane Patching))
- RC Standard 30M (Subsurface Drains)
- RC Standard 31M (End walls Cast-in Place & Precast)
- RC Standard 32M (Slope Pipe Fittings, Pipe Connectors, and Concrete Collar for Pipe Extension)
- RC Standard 33M (End Sections for Pipe Culverts)
- RC Standard 36M (Spring Boxes)
- RC Standard 39M (Storm Water Manholes)
- RC Standard 40M (Slope Protection)
- RC Standard 43M (Gabions)
- RC Standard 46M (Inlet Boxes)
- RC Standard 50M (Guide Rail to Bridge Barrier Survey Transitions, Thrie-Beam Guide Rail Survey Transitions)
- RC Standard 51M (Type 31 Strong Post Guide Rail, Guide Rail with Curb and One Omitted Post)
- RC Standard 53M (Type 2 Weak Post Guide Rail)
- RC Standard 54M (Barrier Placement at Obstructions, Typical Type 2 Weak Post Guide Rail Treatments)
- RC Standard 55M (Concrete Median Barrier Survey Transitions Roadway Barrier to Roadway Barrier)

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- RC Standard 56M (Concrete Median Barrier Survey Transitions Roadway Barrier to Bridge Barrier)
- RC Standard 57M (Concrete Median Barrier)
- RC Standard 58M (Single Face Concrete Barrier)
- RC Standard 59M (Single Face Concrete Barrier Survey Transitions)
- RC Standard 60M (Right-of-Way Fence)
- RC Standard 63M (Permanent Barricades Aluminum Panel)
- RC Standard 64M (Curbs and Gutters)
- RC Standard 65M (Concrete Mountable Curbs)
- RC Standard 67M (Curb Ramps and Sidewalks New Construction or Alteration Details)

[PUB 111](#) Traffic Control-Pavement Markings and Signing Standards

- TC Standard 8604 (Delineation)

[PUB 213](#) Temporary Traffic Control Guidelines

[PUB 219M](#) Standards for Bridge Construction (BC)

- BC Standard 731M (Standard Cement Concrete Slope Wall)
- BC Standard 781M (Standard Random Stone Slope Wall)
- BC Standard 788M (Standard Typical Waterproofing and Expansion Details – Abutment Prestressed I-Beam Bridges)

[PUB 408](#) Highway Construction Specifications

- Section 106 (Control of Material)
- Section 108 (Performance and Progress)
- Section 212 (Geotextiles)
- Section 350 (Subbase)
- Section 410 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed HMA Fine-Graded Courses)
- Section 460 (Asphalt Tack Coat)
- Section 601 (Pipe Culverts)
- Section 603 (Metal Plate Culverts)
- Section 605 (End walls, Inlets, Manholes, and Spring Boxes)
- Section 606 (Grade Adjustment of Existing Miscellaneous Structures)
- Section 607 (Rebuilt Miscellaneous Structures)
- Section 610 (Pipe Underdrain and Pavement Base Drain)
- Section 612 (Subgrade Drains)
- Section 613 (Stone Backfill for Miscellaneous Drainage)
- Section 615 (Subsurface Drain Outlets)
- Section 616 (End Sections and Slope Pipe Fittings)
- Section 617 (Slotted Drains)
- Section 618 (Concrete Collar for Pipe Extension)
- Section 619 (Permanent Impact Attenuating Devices)
- Section 620 (Guide Rail)
- Section 623 (Concrete Median Barrier)
- Section 624 (Right-of-Way Fence)
- Section 626 (Gabions)
- Section 630 (Plain Cement Concrete Curb)
- Section 633 (Plain Concrete Mountable Curb)

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- Section 636 (Asphalt Concrete Curb)
- Section 640 (Plain Cement Concrete Gutter)
- Section 641 (Plain Cement Concrete Curb Gutter)
- Section 660 (Rumble Strips)
- Section 663 (Brick Masonry)
- Section 664 (Modular Architectural Block System)
- Section 667 (Cement Concrete Paving for Stream Beds)
- Section 673 (Precast Cement Concrete Block Slope Wall, CIP Cement Concrete Slab Slope Wall)
- Section 674 (Stone Slope Walls)
- Section 675 (Random Stone Slope Wall)
- Section 676 (Cement Concrete Sidewalks)
- Section 677 (Selected Material Surfacing)
- Section 678 (Permanent Barricades)
- Section 679 (Slab Stabilization)
- Section 680 (Waterproofing)
- Section 681 (Slabjacking)
- Section 686 (Construction Surveying)
- Section 695 (Detectable Warning Surface)
- Section 696 (Temporary Impact Attenuating Devices)
- Section 697 (Reset Temporary Impact Attenuating Devices)
- Section 703 (Aggregate)
- Section 704 (Cement Concrete)
- Section 705 (Joint Material)
- Section 709 (Reinforcement Steel)
- Section 711 (Concrete Curing Material and Admixtures)
- Section 713 (Masonry Units)
- Section 714 (Precast Concrete Products)
- Section 735 (Geotextiles)
- Section 1001 (Cement Concrete Structures)
- Section 1109 (Guide Rail and Metal Median Barrier)
- Section 1110 (Right-of-Way Fence)
- Section 1119 (Thrie Beam Guide Rail)

Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
([ASTM C-939](#))

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SECTION 800: ROADSIDE DEVELOPMENT

GOALS

- **Green Infrastructure:** Ensure all specified vegetation, such as trees, shrubs, and grasses, in roadside development are planted as required to help reduce soil erosion and control sedimentation. This vegetation helps filter pollutants from stormwater runoff.
- **Stormwater Management:** Ensure the stormwater management practices, such as installing catch basins, detention ponds, or infiltration systems, are implemented in accordance with the permit to eliminate runoff and prevent sediment and pollutants from entering nearby bodies of water.
- **Erosion Control Measures:** Ensure the erosion control measures, such as compost filter socks, silt fences, or erosion control blankets, are implemented in accordance with the permit to eliminate soil from washing away during construction activities or heavy rainfall.
- **Soil Stabilization:** Ensure the erosion-resistant materials, such as seeding and mulching, geotextiles, or riprap, are installed in accordance with the permit to stabilize slopes and prevent soil erosion.
- **Sediment Control:** Ensure the sediment basins or sediment traps are installed in accordance with the permit to capture sediment before it enters nearby water bodies.
- **Proper Maintenance:** Verify the contractor performs regular maintenance of all roadside stormwater management facilities and erosion and sedimentation (E&S) control measures.

ROADSIDE DEVELOPMENT SAFETY

- **Traffic Control:** Properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** A roadside development operation has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Personal Protective Equipment:** Wear proper personal protective equipment (PPE) when working near construction operations especially when herbicides and pesticides are being used.

1. STOCKPILING TOPSOIL OR TOPSOIL MIXTURE, TOPSOIL FURNISHED & PLACED, PLACING STOCKPILED TOPSOIL OR TOPSOIL MIXTURE (SEC. 801, 802, & 803)

This section addresses the process of separating and salvaging topsoil or topsoil mixture encountered during project grading and depositing it in stockpiles at locations within the right-of-way (ROW).

The section also addresses the furnishing and placing of topsoil from on- or off-site stockpiles, preparing indicated areas, and placing topsoil or a topsoil mixture on the prepared areas.

☐ Review  Documentation Required

BEFORE TOPSOIL PLACEMENT & STOCKPILING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ST.2.TPSL.	
☐ 	Ensure clearing and grubbing are completed per PUB 408 Section 201.	
☐	If topsoil is obtained from outside the ROW, obtain documentation verifying the soil quality has the proven ability to sustain crops.	PPCC
☐ 	Ensure the topsoil source, depth, and methods of removal are approved. of the topsoil. Obtain independent testing documentation of the topsoil.	PPCC

DURING TOPSOIL PLACEMENT & STOCKPILING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm that the contractor adequately shreds all the vegetation within the size limits specified in PUB 408 Section 801 or special provisions.	
☐ 	Ensure the removal of topsoil from areas as indicated to a depth of 8 to 12 inches.	

Section 800: Roadside Development

☐		Task	Reference
☐		Verify that the contractor removes all the topsoil, taking care not to mix subsoil with the topsoil.	
☐		As the contractor removes the topsoil from the area, verify that it remains free of foreign material (e.g., rocks, sticks, roots, stumps, and subsoil).	
☐		Ensure that the topsoil and the shredded vegetation are adequately mixed.	
☐		Verify stockpiles are built away from other materials and within the ROW.	
☐		Confirm that the stockpiled topsoil is not compacted.	
☐		Verify that the contractor removes the topsoil from stockpiles using an acceptable method that does not mix the topsoil with foreign material (e.g., rocks, sticks, roots, stumps, and subsoil).	PPCC
☐		Confirm that the contractor reconditions the area of topsoil removal.	
☐		Confirm that soil surfaces are scarified and loosened to a depth of 6 inches and that debris and foreign matter 2 inches or larger are removed.	
☐		Verify that the area of the project to be covered is graded and the soil is loosened to a depth of 2 inches.	
☐		Verify that the topsoil is placed on the prepared areas, and unless otherwise indicated, it is spread and compacted to a 4-inch uniform depth of $\pm 1 \frac{1}{2}$ inches.	
☐		When placing topsoil, ensure that the loosened soil is moistened to optimum moisture content.	
☐		Ensure that the material is reasonably dry and unfrozen.	
☐		Confirm that the material is properly compacted with a sheepsfoot roller.	
☐		Ensure that the compactor is within the weight range of 120 lb. per foot as specified in PUB 408 Section 802.3.	
☐		Confirm that the contractor returns unused topsoil or topsoil mixture to stockpiles and reconditions the area of topsoil removal.	
☐		Ensure that the seeding and soil supplements are applied as specified in PUB 408 Section 804.	

AFTER TOPSOIL PLACEMENT & STOCKPILING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure that the topsoil stockpiles are kept moist but not wet.	
☐		Verify that the stockpiled topsoil that is not needed for the project is graded.	
☐		Confirm that the mulch is applied as directed in PUB 408 Section 805.	
☐		Ensure that all E&S requirements for the stockpiles have been met.	MCDocs

Material & Equipment

Topsoil consists of friable loamy soil with organic material reasonably free of subsoil, clay, lumps, stones, roots, and branches. A topsoil mixture consists of topsoil combined with organic plant matter, such as crushed or shredded tree branches, stems, bark, leaves, seeds, and roots.

Equipment used in the stockpiling and placement process includes bulldozers, excavators, front end loaders, scrapers, sheepsfoot rollers, graders, and gradalls, as well as hauling equipment such as a dump truck.

Additional equipment, such as a tree harvester or loader, is needed for processing topsoil mixtures. The contractor may also use hand tools, such as shovels and rakes, and a tractor with a stone rake.

Equipment used for seeding and mulching includes hydroseeders, mulch blowers, and hand spreaders.

Mechanical:				
Bulldozer	Dump Truck	Excavator	Front End Loader	Gradall
Grader	Hydroseeder	Mulch Blower	Scraper	Sheepsfoot Roller
Tree Harvester	Vibratory Steel Wheel Roller			
Hand Tools:				
Rake	Shovel			

Construction Methods

The contractor is responsible for removing on-site topsoil or topsoil material after clearing and grubbing and prior to other construction. Refer to PUB 408 Section 201.

Stockpiling Topsoil

Once the clearing and grubbing (removal of stumps and roots) are completed and verified by the inspector, the contractor uses a bulldozer or scraper to push the topsoil off the subsoil and into piles. If the slope is too steep for a bulldozer or scraper, an excavator or gradall may be used for removing topsoil. Care must be taken to avoid mixing the subsoil with the topsoil.

If the topsoil is to be stockpiled off-site, it is loaded into hauling vehicles and delivered to the designated stockpile area.

A stockpile is constructed using a front end loader or bulldozer. The topsoil must not be compacted or stockpiled in wet or frozen conditions. The project E&S plan may require seeding and mulching of the stockpile and/or other E&S control measures. The stockpile area should be within the ROW or easement area unless the contractor has obtained approval for the off-site storage.

Unused topsoil should be leveled and graded uniformly as specified in PUB 408 Section 803, then seeded and mulched as described in PUB 408 Sections 804 and 805.

Stockpiling Topsoil Mixture

During clearing and grubbing, the contractor uses a self-powered land-clearing shredder to shred all vegetation as specified in PUB 408 Section 801. A bulldozer is used to push the topsoil and the pulverized vegetation off the subsoil and into piles to create a topsoil mixture. If the slope is too steep for a bulldozer or scraper, an excavator or gradall may be used to remove the material.

If the topsoil mixture is to be stockpiled off-site, it is loaded into hauling vehicles and delivered to the designated area.

A stockpile is constructed using a front end loader or bulldozer. The topsoil mixture must not be compacted and must be kept moist. The project E&S plan may require seeding and mulching of the stockpile and/or other E&S control measures. The stockpile area should be within the ROW or easement area and not in the way of future construction unless the contractor has obtained approval for the off-site storage.

Topsoil Furnished & Placed

After the topsoil is removed from an off-site location, the contractor must recondition the removal area by grading the area, preparing the surface for seeding, and seeding and mulching the area. The contractor prepares the area for topsoil placement as specified in PUB 408 Section 802. Once the site is prepared, the topsoil is placed, spread, and compacted as specified in PUB 408 Section 802.

Stockpiled Topsoil Placement & Stockpiled Topsoil Mixture Placement

The contractor should use a method of removing the topsoil from the stockpiles that does not contaminate the topsoil with foreign materials.

The contractor prepares the area for topsoil or topsoil mixture placement as specified in PUB 408 Section 802. Once the site is prepared, the topsoil or topsoil mixture is placed, spread, and compacted as specified in PUB 408 Section 803. Any unused stockpiles of topsoil or topsoil mixture should be uniformly graded, then seeded and mulched.

Measuring & Payment Methods

No separate payment will be made for stockpiling of topsoil. Payment for topsoil furnished and placed is measured by the hauling trucks at the delivery point and paid by the cubic yard. The inspector measures and records the inside dimensions of the truck beds to calculate the volume of the truck. The inspector then counts the number of loads hauled and multiplies the total number of loads by the truck volume to arrive at a pay quantity. Payment for topsoil furnished and placed can also be measured in place and paid by the square yard.

2. SEEDING & MULCHING (SEC. 804 & 805)

This section addresses seeding and soil supplementation in areas disturbed by earthwork. The work includes seeding of the specified seed mix, applying soil supplements, including lime and fertilizer, and mulching with hay, straw, wood fiber, or pellet mulch, mulch tack, and mulch control netting to encourage plant growth.

☐ Review  Documentation Required

BEFORE SEEDING & MULCHING CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Review PUB 464 Section ST.1.SEED.	
☐		Review PUB 888 Chapter 4.2.	
☐		Ensure the certified seed is tested and certified or from a pre-approved supplier with a Pennsylvania Seed Dealers License.	
☐		Verify the seed is delivered in unopened bags.	
☐		Confirm the seed has a sell date that is less than 15 months from inspection testing.	

DURING SEEDING & MULCHING CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the seed mixtures are placed in accordance with the approved plans.	MCDocs
☐		Verify the contractor applies the seeding mixture evenly and at the rate specified in PUB 408 Section 804.	
☐		Confirm the contractor applies the mulch binder and mulch at the correct rates specified in PUB 408 Section 805.	
☐		Ensure that the mulch control netting is placed in accordance with PUB 408 Section 805.3 and is stapled or staked to ensure that the wind will not displace it.	

Section 800: Roadside Development

☐		Task	Reference
☐		Verify the appropriate mulch is applied for the type of seed used (e.g., straw on Formula B and Formula L seed; hay on the remaining formulas). Note: Wood mulch is not to be used where the native seed is hydro seeded. The tackifier is not to exceed ½ inch thick.	
☐		Confirm the contractor uses the proper quantities of fertilizer, lime, and inoculant and maintains growth to the final inspection.	

AFTER SEEDING & MULCHING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the seeding areas are measured and seeding quantities determined.	
☐		Verify that the contractor maintains the grass and legume ground cover areas within the grading limits until the entire project has been completed. Verify that mowing is completed as specified in PUB 408 Section 804.3 .	
☐		Confirm the water is obtained from an acceptable location.	
☐		Ensure that when water is obtained from fire hydrants, it is metered.	

Material & Equipment

The seed used must be appropriately formulated, inspected, and certified by the Pennsylvania Department of Agriculture or from a pre-approved supplier with a Pennsylvania seed dealer's license. Soil supplements include fertilizer, pulverized agricultural lime, inoculants for treating legumes, and herbicides conforming to applicable federal and state pesticide regulations. Hay, straw, wood fiber, or pellet mulch is used to maintain moisture and inhibit weed growth. Mulch binder, a fibrous, biodegradable blend of organic matter, is mixed with water and sprayed onto the mulch to hold it in place. Mulch control netting, comprised of plastic or coconut coir yarn, may also be installed to hold the mulch in place.

The contractor uniformly spreads the seed mixture at the appropriate rate by hand or mechanical spreader and immediately applies a uniform mulch blanket. Flatbed trucks are used to haul the material to the work site.

Mechanical:				
Flatbed Truck	Hydroseeder	Mulch Blower	Seed Spreader	Vibratory Steel Wheel Roller

Hand Tools:				
Rake	Shovel			

Construction Methods

Seeding & Mulching

Final grading and cleanup should be performed as part of the excavation. Seed and mulch are not to be applied until the area is at the final grade unless the area is to be temporarily seeded to prevent erosion until a final grade is achieved. As part of the cleanup, large rocks and debris that would interfere with the efficient mowing of the area are removed.

The seeding formula is applied according to the table in PUB 408 Section 804 within the allowable seeding rates. Water is obtained from an acceptable location. The quantity of seed, fertilizer, lime, and inoculant is determined by the size of the area to be seeded. Due to capacity limitations, the contractor may need to mix seeds in several small batches.

The seed mixture is applied to prepared areas at or above the specified rate. For topsoil areas, the soil is loosened as specified in PUB 408 Section 804 prior to the application of the seeding mixture.

Mulch and mulch binder are applied in a uniform blanket at or above the specified rate.

Mulch Control Netting

Mulch control netting may be installed after the seed mixture, mulch, and mulch binder are applied, as specified in PUB 408 Section 805. If coconut coir netting is used, the fabric is stretched over the mulch and anchored with wood stakes along its edges, as specified in PUB 408 Section 805.

Measuring & Payment Methods

The contractor is paid for the actual pounds of seed used. However, the inspector must calculate the application rate (pounds per square yard) of seed, soil supplements, and mulch to ensure that the minimum seeding and mulching rates in PUB 408 Sections 804 and 805 have been met.

The seeding application rate is calculated in two steps. First, the surface area of the seeded locations is determined by measuring the dimensions of the seeded areas and calculating the square yards covered. Refer to PUB 408 Section 804 Table A for seed application rates. Second, this area is divided by the number of pounds of seed used to cover the area. The result is the seeding application rate. The same process is followed when calculating the mulch (tons). For mulch application rates, refer to PUB 408 Section 805.

Mulch control netting, weed barrier mat, weed control mat, and bonded fiber matrix are paid in square yards. The length and width of the area covered are measured and multiplied together to calculate the surface area. Overlaps are only measured once.

3. ROLLED EROSION CONTROL PRODUCTS (SEC. 806)

This section addresses rolled erosion control products (RECP) for temporary and permanent erosion protection in accordance with PUB 408 Section 806.

☐ Review  Documentation Required

BEFORE RECP CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Sections ST.6.ECB and ST.7.TRM.	

DURING RECP CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that, if required, seed and mulch are applied prior to RECP placement.	
☐	Verify that the area requiring RECP is at the final grade and is properly dressed.	
☐ 	Confirm the RECP is applied without stretching or deforming.	
☐ 	Ensure that the anchors are driven so that their tops are flush with the ground.	

AFTER RECP CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Ultra-short-term, short-term, extended-term, and long-term temporary RECPs have a functional longevity of sufficient duration to allow the establishment of permanent vegetation before RECP degradation.

Permanent RECPs are capable of permanently reinforcing vegetation in applications where vegetation alone cannot provide sufficient protection against erosive forces.

Mechanical:				
Flatbed Truck				
Hand Tools:				
Hammer	Rake			

Construction Methods

The area is final graded, and soil surfaces are dressed to receive seeding. Soil surfaces are free of rocks or other obstructions that would prevent direct contact with the soil. The RECP is unrolled evenly and anchored with staples or anchoring pins that are placed flush with the soil surface.

Overlap the edges of the adjacent RECP by 2 to 4 inches as per manufacturer recommendations.

Measuring & Payment Methods

All temporary and permanent RECPs are paid by the square yard.

4. PLANTS, PLANTING, & TRANSPLANTING (SEC. 808)

This section addresses the furnishing and placement of trees, shrubs, vines, and other woody and herbaceous plants. The work incorporates mulching around trees (placement of shredded bark, gravel, compost, or wood chips) and the preparation of beds for shrubs or herbaceous plants (tilling, weed barrier placement, and mulching).

☐ Review  Documentation Required

BEFORE PLANTS, PLANTING, & TRANSPLANTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the state nursery inspection certificate is provided with each shipment.	
☐	Verify that the plants are healthy and ready to plant.	
☐	Confirm the plants are stored properly and protected from the elements.	
☐	Ensure that the planting locations are determined and marked.	MCDocs
☐	Verify the work is being performed with the dates specified in PUB 408 Section 808 or that an extension is approved.	PPCC

DURING PLANTS, PLANTING, & TRANSPLANTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the planting site is prepared and that foreign materials are removed.	
☐ 	Verify that the plant pits and shrub beds are prepared in accordance with the standard drawings and contract provisions.	MCDocs
☐	Confirm that care is taken not to damage the plants during the planting process.	
☐ 	Ensure that an adequate amount of the correct fertilizer is provided during planting.	

Section 800: Roadside Development

☐		Task	Reference
☐		Verify that the root ball lacing is cut, untied, and laid back or that the top 1/3 of the burlap wrap is removed and the top 1/3 of any root ball wire protective baskets are removed.	
☐		Confirm the plants are adequately watered during planting.	
☐		Ensure that the root systems of the trees are not damaged while placing tree stakes.	
☐		Verify that the tree stakes and shelters, if required, are installed as soon as the planting is complete.	
☐		Confirm that the tree tie straps are installed properly.	
☐		If required, ensure that the proper type and amount of mulch, if any, is used.	

AFTER PLANTS, PLANTING, & TRANSPLANTING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that the plantings are properly maintained during the establishment period as indicated in Section 808.3.	

Material & Equipment

Materials for the work include plant and nursery stock, collected plants, balled and burlapped (B&B) plants, container-grown herbaceous and crown vetch plants, and live stakes. Fertilizer, backfill mix, soil amendments, compost, as well as stakes and collar strap attachments to stabilize plantings.

The contractor uses a variety of equipment to haul and place materials, including pickup trucks, medium-duty stake trucks, all-terrain vehicles, small loaders or backhoes, and tractors with post hole augers or front end loaders. Hand tools, such as mattocks and shovels, are also used in the work.

Mechanical:				
All-Terrain Vehicle	Backhoe	Front End Loader	Pickup Truck	Stake Truck
Tractor with Post Hole Auger				

Section 800: Roadside Development

Hand Tools:				
Mattock	Shovel			

Construction Methods

Once the inspector has verified the location for each type of plant, the contractor prepares the planting area. Preparation includes digging holes, applying fertilizer or mulch, and installing tree stakes, tree shelters, or tree ties if required. If small seedlings are planted in an area of existing growth, tree shelters should be installed immediately after planting.

Measuring & Payment Methods

Plants are paid as each, based on verification of the number of plants for each individual item number and plan location.

Shrub bed preparation is paid for by the square yard. The inspector measures the dimensions and calculates the size of the bed in square yards. Weed barrier mats and mulching are also paid for by the square yard for planting beds, based on the inspector's calculations. If the mat or mulch is placed at a planting pit for an individual plant, payment is incidental.

Initial watering is incidental to plant placement. Maintenance watering is paid at a price per 1,000 gallons.

5. SODDING (SEC. 809)

This section addresses the furnishing, placement, and cultivation of established turf grass (sod) on a designated prepared surface.

☐ Review  Documentation Required

BEFORE SODDING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the soil is approximately $\frac{3}{4}$ inch thick, excluding top growth and thatch.	
☐	Verify that the material is relatively free of thatch (up to $\frac{1}{2}$ inch uncompressed thickness).	
☐	Confirm the sod is placed within 36 hours of being cut.	
☐	Ensure that the sod is free of weeds, insects, and diseases.	
☐	Verify that the height of the grass is less than 1 $\frac{1}{2}$ inches.	
☐	Confirm that the cut sod has been kept sufficiently moist.	

DURING SODDING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the sod bed is graded and moistened prior to sod placement.	
☐ 	Verify that the air and sod temperatures are above freezing.	
☐ 	Confirm that the sod is not placed when the ground is frozen or when freezing conditions are present. Verify that the sod is maintained as specified in PUB 408 Section 809.	
☐ 	Ensure that the joints between sections of sod are tight and the transverse joints are staggered.	

Section 800: Roadside Development

☐		Task	Reference
☐		Verify that the sod is moistened after placement and prior to tamping.	
☐		Confirm that the placed sod is tamped to a smooth, even finish.	

AFTER SODDING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the sod is properly maintained per PUB 408 Section 809.3 standards until the project is accepted.	

Material & Equipment

The grass comprising the sod should be of two or more Kentucky bluegrass varieties, with no more than 10 percent of the sod comprising other fine-bladed turf grass species. The sod must be free of weeds, harmful insects, and disease and be certified by the Pennsylvania Department of Agriculture from which the sod is obtained. The sod should also be relatively free of thatch and well-moistened.

The sod typically comprises segments 12 to 24 inches wide and 2 to 6 feet long. The root system should be approximately $\frac{3}{4}$ inch thick, excluding top growth and thatch, with a grass height of no more than $1\frac{1}{2}$ inches.

Equipment used in the sod bed preparation includes bulldozers, excavators, front end loaders, and compactors, as well as hauling equipment such as dump trucks.

In placing the sod, the contractor uses equipment such as a small front end loader, usually of a skid-steer type, and a small roller. Hand tools, including shovels and hand tampers, are also used.

Mechanical:				
Bulldozer	Dump Truck	Excavator	Front End Loader	Soil Compactor
Vibratory Steel Wheel Roller				
Hand Tools:				
Hand Tamper	Shovel			

Construction Methods

The contractor must place the sod within 36 hours of harvest. If the sod must be stored temporarily, the contractor must protect it from drying out.

In preparing the site, the contractor grades the area to be covered as specified in PUB 408 Section 809. The contractor places the sod by hand; joints should be tight, and pieces should not overlap. The sod should be placed in a straight line with the rows placed tightly against each other, with transverse joints broken or staggered.

The sod should be moistened before and after it is placed. Once the sod is completely in place, the top of the sod should be flush with the surrounding finished grade, and lime and fertilizer should be applied. After the sod is saturated, it should be tamped to close the joints and ensure good contact with the sod bed. The surface should be tamped smooth, even, and free of bumps and depressions. A roller may be used to complete the firming and smoothing of the sod, provided it meets the mass requirements noted in PUB 408 Section 809.3.

Measuring & Payment Methods

Sodding is paid by the square yard based on the measured dimensions of the placed sod. Initial watering and mowing at the time of sodding are incidental. Additional watering, if directed, is paid for by the 1,000 gallons. The water used can be measured using a flow meter or by counting the number of tanks of water of a known volume and multiplying the total loads by the volume of the tank.

If additional mowing is required after the initial mowing, it will be paid in acres. The inspector should measure the dimensions of the area mowed, calculate the area in square feet, and convert it to acres.

6. TREE TRIMMING & SELECTIVE TREE REMOVAL (SEC. 810).

This section addresses the removal or trimming of trees and shrubs within or immediately adjacent to the ROW. This work also includes the treatment of tree injuries and the removal of stumps, debris, and unwanted vegetation.

☐ Review  Documentation Required

BEFORE TREE TRIMMING & SELECTIVE TREE REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	If the contractor is placing herbicides or pesticides, obtain a copy of the applicator's license issued by the PA Department of Agriculture.	
☐	Review local and Department of Environmental Protection (DEP) regulations for burning and stump disposal.	
☐	Verify that the trees and vegetation to be removed are marked.	

DURING TREE TRIMMING & SELECTIVE TREE REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the removed trees and shrubs are cut at the ground line or to a height of not more than 4 inches, as directed.	
☐	Verify that the tree removal does not damage surrounding vegetation.	
☐ 	Confirm that any injuries to remaining trees and shrubs are appropriately treated.	
☐	Ensure that brush, limbs, and other debris are disposed of properly.	
☐ 	Verify that herbicide is applied to live stumps on the day of cutting.	

AFTER TREE TRIMMING & SELECTIVE TREE REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Herbicide is the primary material used in this work.

The contractor uses equipment, such as pickup trucks, bucket trucks, bulldozers, and excavators, and tools, including woodchippers, chainsaws, handsaws, tree trimmers (pruners), and stump grinders in the removal, trimming, and treatment of trees and shrubs.

Dump trucks are used to haul the debris from the work site.

Mechanical:				
Bucket Truck	Bulldozer	Dump Truck	Excavator	Pickup Truck
Stump Grinder	Woodchipper			
Hand Tools:				
Chainsaw	Handsaw	Pruners		

Construction Methods

Trees and shrubs to be removed will be designated either by separate markings or sample areas.

The contractor must cut any tree, shrub, or other vegetation to be removed to the ground line or a height specified in PUB 408 Section 810. Trees should be removed in such a way that they will not damage the surrounding vegetation. If removal cannot occur without damaging the surrounding vegetation, the tree should be sectioned as it is removed.

The contractor applies herbicide to live stumps on the day of cutting and according to the manufacturer's directions. If suckers or sprouts develop on stumps prior to final inspection, the stumps must be retreated with herbicide. Utilize the proper PPE as required for the type of herbicide being used.

When trimming trees, the contractor removes living and dead branches as specified in PUB 408 Section 810. Work-related injuries to the remaining trees and shrubs are treated according to accepted agricultural practices.

Measuring & Payment Methods

Selective tree removal is paid as a lump sum, or each based on the number of trees removed.

Tree trimming is paid by lump sum or by linear foot, measured longitudinally along the roadway.

Selective tree trimming is paid for by each.

7. TEMPORARY PROTECTIVE FENCE (SEC. 811)

This section addresses the erection of a temporary protective fence for delineating and protecting existing wetlands and areas of plant materials from construction activities in accordance with PUB 408 Section 811.

☐ Review  Documentation Required

BEFORE TEMPORARY PROTECTIVE FENCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify that the area to be fenced off requires protection and is in accordance with the contract documents and field observations.	

DURING TEMPORARY PROTECTIVE FENCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify that the fence and posts are of acceptable quality per PUB 408 Section 811.2.	
☐	Ensure that the completed fence provides a substantial barrier against entry into the protected area.	

AFTER TEMPORARY PROTECTIVE FENCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials used include standard picket snow fence, orange safety fence, or other suitably sufficient, highly visible fencing, along with high-carbon steel posts capable of holding the fencing material to create a substantial barrier.

The contractor uses equipment such as a pickup truck, sledgehammers, and fence post bars in the construction of the temporary protective fence.

Section 800: Roadside Development

Mechanical:				
Pickup Truck				
Hand Tools:				
Sledgehammer				

Construction Methods

The contractor will place the fence in accordance with the E&S plan prior to clearing and grubbing operations. Posts are driven as needed around the area to be protected. Fencing is attached to the posts with tie-wire.

The contractor must ensure that the fence remains in place and that no one enters the area within the protective fence. No material is to be stockpiled in this area.

Measuring & Payment Methods

Protective fencing is paid for by the linear foot. The inspector measures the actual length placed and uses that measurement to calculate the payment.

8. EROSION & SEDIMENTATION CONTROL MEASURES / ENVIRONMENTAL COMPLIANCE

This section addresses E&S control measures and issues related to environmental compliance.

E&S occurs naturally; however, the rate at which E&S occurs can be accelerated by construction excavation or soil disturbance, a lack of vegetation to protect the soil, or excessive changes in topography. These conditions can readily erode and transport soil into nearby waterways, clogging them with fine sediments known as silt, clay, or colloids. Runoff from bare soil may also contain chemicals and other pollutants that may be washed into waterways.

To control sediment pollution, Pennsylvania's DEP's Chapter 102 Erosion and Sedimentation Control regulations require that all persons, agencies, and municipalities engaged in earth disturbance activities develop, implement, and maintain E&S control measures. DEP also requires that the E&S measures be set forth in a plan and always available in paper form at the site during construction.

Refer to PUB 2 Part B.4.10 and PUB 408 Section 107.28 for details on the requirements for monitoring compliance. A summary of inspector requirements is as follows:

- Review the E&S plans for the project.
- Review the permit requirements and construction mitigation requirements in ECMS and perform the site inspections as required.
- Chapter 102 permit projects are required to have weekly, post-rainfall, and corrective action visual site inspections. Rainfall-triggered inspections must be conducted within 24 hours after each measurable stormwater event, which is defined as $\frac{1}{4}$ inches or more of rainfall. These site inspections are to be documented using the Visual Site Inspection Report (VSIR) mobile application.
- For projects without a Chapter 102 permit but that require an E&S plan, a weekly visual site inspection is required for the duration of the active earth disturbance. These inspections are to be documented using the VSIR mobile application.
- Discuss construction mitigation requirements with the Inspector-in-Charge (IIC) to determine which requirements are required to inspect and document. Refer to PUB 2 Part B.4 for further guidance. These inspections are documented in the Project Site Activity (PSA) Construction Mitigation section.

An E&S plan is used to identify potential erosion problems and to define effective and economic measures to be used to stabilize the project site along with a proper construction sequence. A properly implemented E&S plan assists in controlling E&S during the construction process rather than waiting until construction is complete. The plan is also intended to minimize the flow of any sediment and other pollutants generated during the construction project into nearby waterways.

The inspector is to review the E&S plan to verify that all ongoing construction operations are contained within the approved Limit of Disturbance (LOD). Notify the IIC whenever there is an earth disturbance or construction activity occurring outside the LOD.

Several control measures are discussed in this section. These include unforeseen water pollution control, rock construction entrance, rock lining, outlet protection-rock, paved energy dissipator, temporary slope pipe, pumped water filter bag, rock barrier, concrete block revetment system, geocell confinement system, sedimentation pond, storm inlet protection, cleaning sedimentation structures, diversion ditch, silt barrier fence, heavy-duty silt barrier fence, compost filter sock, compost blanket and compost filter berm, sediment trap-embankment, sediment trap-riser, sediment basin, temporary baffle wall, temporary riser pipe assembly, and concrete outlet structure.

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During a construction project, everyone's goal is to control erosion and the resulting pollution of the waters of the Commonwealth. This can be partially achieved by thoughtful planning and scheduling of construction earthmoving activities.

A. UNFORESEEN WATER POLLUTION CONTROL (SEC. 845)

This subsection addresses the construction or installation of temporary or permanent control measures, as ordered during the contract life, to control unforeseen pollution of surface and groundwater in accordance with PUB 408 Section 845.

☐ Review  Documentation Required

BEFORE UNFORESEEN WATER POLLUTION CONTROL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 .	
☐	Review PUB 888 .	
☐ 	Review the construction plans and E&S plans.	
☐ 	Verify that the water pollution control methods are in place prior to earthwork operations.	
☐	Ensure that if the work includes any permits or additional approved plans by other agencies, copies of the permits are on file in the project field office.	

DURING UNFORESEEN WATER POLLUTION CONTROL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that any interferences with the free discharge of any waterways during construction are remediated.	
☐	Verify that all inlets, ditches, or any type of drainage system are protected from sediment.	
☐	Confirm that excavated material is not placed in swales or ditches.	
☐	Ensure that streambeds are not used as a roadway between operation sites.	

☐		Task	Reference
☐		Verify that all water originating outside of the construction project is kept separate from water originating within the project.	

AFTER UNFORESEEN WATER POLLUTION CONTROL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that water pollution control devices are inspected regularly to ensure that the contractor is maintaining and continuing controls.	

Material & Equipment

Utilize the appropriate E&S pollution control devices and the required equipment to install the devices as shown on the standard drawings and contract documents. Water pollution control measures and devices are used as directed. These devices may include erosion control blankets and mats, geotextile fabrics, silt barrier fences, inlet protection, rocks, and straw bales.

The type of equipment required is dependent upon the type of work needed to install unforeseen water pollution control. Equipment may not be needed for installation. See other subsections of the 800 section for the equipment used.

Construction Methods

The contractor is required to provide water pollution control measures to prevent or abate unforeseen pollution of surface and groundwater resources. It is also the contractor's responsibility to install, maintain, and monitor all necessary E&S control measures and facilities during the construction project.

Measuring & Payment Methods

The proposal will include an item and a predetermined amount (PDA) of money for unforeseen water pollution control. The contract item will have a unit of measure of dollars, a unit price of \$1.00, and a quantity equal to the predetermined amount.

- **Contract Items:** The Department will pay for the performance of work identified as having similar items listed in the contract at the contract unit price.
- **Non-Contract Items:** The Department will pay for items of work not identified in the contract as follows:
- **Negotiated Price:** At the price agreed upon with the Department before performing the work. If applicable, an agreement is also required with the Federal Highway Administration (FHWA).
- **Force Account Basis:** See PUB 408 Section 110.03.

B. ROCK CONSTRUCTION ENTRANCE (SEC. 849)

This subsection addresses the construction, maintenance, and removal of a temporary rock construction entrance (RCE) in accordance with PUB 408 Section 849.

☐ Review  Documentation Required

BEFORE RCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ES.14.RCE.	

DURING RCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Ensure that the geotextile is installed unstretched so as not to tear or damage the material.	
☐	Verify that the rock is not placed by any dumping methods that could cause segregation or geotextile damage.	
☐	Verify that the RCE is constructed to the dimensions and thickness in accordance with PUB 72M RC Standard 77M.	

AFTER RCE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the RCE is removed and the area is restored per PUB 408 Section 105.14 when the construction entrance is no longer needed.	

Material & Equipment

Materials used include AASHTO No. 1 aggregate, geotextiles, and wash racks.

Equipment used to install the rock construction entrances include tri-axle dump trucks, front end loaders, and excavators to haul and place the aggregate material.

Mechanical:				
Excavator	Front End Loader	Tri-Axle Dump Truck		

Construction Methods

The contractor clears and grubs the area for the RCE, grades to the proper elevations, and places geotextile, aggregates, and the wash rack. The wash rack is placed to direct the water to the sediment removal device. Additional rock is placed to satisfactorily maintain the RCE. Sediment is disposed of in a satisfactory manner.

Measuring & Payment Methods

The RCE and/or RCE with wash rack are paid for by each.

Aggregate is paid by the cubic yard.

Geotextile is paid in accordance with PUB 408 Section 212.4.

Class 1 Excavation is paid in accordance with PUB 408 Section 203.4.

Wash rack is paid for by each each.

C. ROCK LINING (SEC. 850)

This subsection addresses the construction of an indicated class rock lining, which is a measure to prevent excessive soil erosion under the rock from an existing flow channel.

☐ Review

 Documentation Required

BEFORE ROCK LINING CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Review PUB 464 Section ES.11.LING.	
☐		Verify that the area to be protected is satisfactorily prepared by means of excavating, backfilling, placing embankment, and/or clearing and grubbing.	

DURING ROCK LINING CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure that the geotextile is installed unstretched so as not to tear or damage the material.	
☐		Verify that the geotextile is installed along interface areas with ground contact, as specified.	
☐		Confirm that the rock is placed at a nominal thickness in one operation per PUB 408 Section 850.	
☐		Ensure that the rock is not layered by any dumping methods that could cause segregation or geotextile damage, per PUB 408 Section 850.3.	

AFTER ROCK LINING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The material and equipment needed to construct the rock lining include rocks of a specified size and Class 4 Type A geotextile.

In constructing the rock lining, the contractor uses a front end loader, backhoe, an excavator, dump trucks, concrete mixer trucks, and grout mixer, as well as various hand tools.

Mechanical:				
Backhoe	Concrete Mixer	Concrete Mixer Truck	Dump Truck	Excavator
Front End Loader				
Hand Tools:				
Concrete Vibrator	Rake	Shovel	Wheelbarrow	

Construction Methods

The contractor prepares the area for the rock lining; work may include backfilling or excavation to remove unsuitable material and large stones from the protected area. The area is graded to a relatively smooth condition and constructed with a 2:1 slope, per PUB 72M RC Standard 70M unless otherwise specified.

The contractor places the Class 4 Type A geotextile as directed. Specified rock is then placed (according to the design) onto the geotextile material in an even distribution pattern, minimizing voids, using equipment such as a gradall, backhoe, or track excavator. Rocks may be rearranged after placement to produce a uniform distribution.

Measuring & Payment Methods

In rock lining, the rock is paid by the square yard or cubic yard.

Geotextile is paid by the square yard, and excavation is paid by the cubic yard for the class indicated.

D. OUTLET PROTECTION: ROCK (SEC. 851)

This subsection addresses the construction or installation of temporary or permanent control measures, as ordered during the contract life, to control unforeseen pollution of surface and groundwater in accordance with PUB 408 Section 851. Work could include the construction of rock basins, rock energy dissipators, rock aprons, and riprap basins, as well as the temporary installation and maintenance of such systems.

☐ Review  Documentation Required

BEFORE OUTLET PROTECTION: ROCK CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ES.9.OUTL.	

DURING OUTLET PROTECTION: ROCK CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Verify that the geotextile is installed unstretched so as not to tear or damage the material.	
☐	Ensure that the geotextile is not damaged during rock placement.	
☐	Confirm that any voids are minimized during rock placement.	
☐	Verify that a full course thickness of rock is placed in one operation in a manner to prevent segregation.	
☐	Ensure that the rock is not placed in layers by dumping into chutes or in any manner likely to cause segregation.	
☐	Confirm that any voids between rocks are filled as specified with approved grout; the surface is then swept with a stiff broom.	
☐	Ensure that the grout is not placed if the air temperature is below freezing.	

☐ 	Task	Reference
☐	Verify that the grouted rock is protected during hot weather using saturated burlap and kept moist for at least three days.	

AFTER OUTLET PROTECTION: ROCK CHECKLIST

☐ 	Task	Reference
☐	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Material for the outlet protection includes rock, Class 4 Type A geotextile, and grout.

In constructing the outlet protection, the contractor uses equipment such as front end loaders, backhoes, excavators, dump trucks, and various hand tools.

Mechanical:				
Backhoe	Dump Truck	Excavator	Front End Loader	Mini Vibratory Roller
Vibratory Plate Compactor				
Hand Tools:				
Rake	Shovel			
Testing/Inspection:				
Concrete Testing Equipment				

Construction Methods

The outlet protection: rock must be constructed per contract plans, standards, and specifications.

The contractor prepares the area for the rock outlet protection; this work may include clearing or grubbing, excavation to remove unsuitable material or large stones, or backfilling of the area to be protected. The area is then graded to a relatively smooth condition.

Geotextile is installed in place along interface areas with ground contact, as specified, and in a loose and unstretched condition. The specified rock size, as shown on construction plans and drawings, is evenly distributed onto the geotextile with a minimum number of voids. The rock is also placed in a manner that will not damage the geotextile. A full-course thickness of rock should

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be placed in one operation in a manner that prevents segregation. Rocks may be rearranged after placement to produce a uniform distribution.

Rocks are then saturated with water, voids between rock pieces filled as directed with approved grout, and the surface swept with a stiff broom. Saturated burlap is used to protect the grouted rock during hot weather and must be kept moist for at least three days after grouting.

Measuring & Payment Methods

Construction of outlet protection: a rock basin and rock energy dissipator are paid as each item, complete in place.

The rock apron and riprap basin are paid for by the square yard.

Temporary installations are paid as each item.

E. PAVED ENERGY DISSIPATOR (SEC. 852)

This subsection addresses the construction of a paved energy dissipator. A paved energy dissipator consists of a reinforced cement concrete channel embedded with stones or solid pre-cast concrete blocks. For more information, refer to PUB 408 Section 852.

☐ Review  Documentation Required

BEFORE PAVED ENERGY DISSIPATOR CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Review PUB 464 Section ES.11.LING.	
☐		Review PUB 888 Chapter 6.10.	
☐		Verify that the foundation area is prepared per plans.	
☐		Obtain approval from the IIC to contact the concrete plant to release concrete.	

DURING PAVED ENERGY DISSIPATOR CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		Witness and document the concrete testing for temperature, air, and slump according to the approved QC plan.	eConcrete
☐		Ensure that the concrete is not dropped more than 4 feet.	
☐		Verify that the reinforcement mesh is held firmly in position during concrete placement.	

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☐		Task	Reference
☐		Verify that the placing, finishing, and curing of concrete is in accordance with PUB 408 Section 1001 and the QC plan.	
☐		Ensure that pre-molded expansion joint filler is placed as specified or at the end of a day's work if required.	
☐		If paving is adjacent to a rigid structure, ensure that joint filler with a depth of ½ inch lower than the paving depth is placed and pressed firmly against the adjacent concrete.	
☐		Verify that the joint tops are properly sealed.	
☐		Confirm that any intermediate joints are formed between sections with two thicknesses of one-ply asphalt paper, cut neatly to the paving cross section per PUB 408 Section 852.3.	
☐		Ensure the concrete curing procedure specified in PUB 408 Section 1001 is followed.	
☐		Verify the paved area is protected from the elements, flowing water, or other disturbances until curing is completed per PUB 408 Section 852.3.	

AFTER PAVED ENERGY DISSIPATOR CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials for the paved energy dissipator include Class A cement concrete, steel reinforcement, joint sealer, pre-molded expansion joint filler, asphalt paper, and precast concrete blocks or stones of acceptable quality if required.

An air meter and slump cone are used to test the concrete prior to placement.

In constructing the paved energy dissipator, the contractor uses excavation and compaction equipment, a concrete mixer and/or concrete delivery truck, concrete testing equipment, concrete vibrators, and various hand and finishing tools.

Mechanical:				
Backhoe	Concrete Mixer	Concrete Mixer Truck	Dump Truck	Excavator

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Mini Vibratory Roller	Vibratory Plate Compactor			
Hand Tools:				
Concrete Vibrator	Rake	Shovel	Trowel	
Testing/Inspection:				
Concrete Testing Equipment				

Construction Methods

The paved energy dissipator must be constructed per contract plans, standards, and specifications.

Prior to constructing the paved energy dissipator, the contractor excavates the area to the required paving depth and removes and replaces any unsuitable material below the bottom of the paving. The area is then compacted to a firm, even surface to provide an acceptable foundation.

Before the concrete is placed, the contractor's certified technician tests all the concrete according to the approved QC plan. Concrete cylinders must also be molded for compressive strength tests if required. The concrete is placed and finished as specified in PUB 408 Section 1001, with reinforcement mesh set in the concrete during placement. The contractor must prepare and construct joints as specified in PUB 408 Section 852.

Measuring & Payment Methods

The construction of a paved energy dissipator is paid for by the cubic yard.

Excavation for the removal of unsuitable material is also paid for by the cubic yard of the same class of excavation for the ditch or channel above the paving.

These are all field-measured and paid on a PSA.

F. TEMPORARY SLOPE PIPE (SEC. 854)

This subsection addresses the installation of a temporary slope pipe drain, used to temporarily drain water from the work area until permanent drainage is installed in accordance with PUB 408 Section 854.

☐ Review  Documentation Required

BEFORE TEMPORARY SLOPE PIPE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ES.8.PIPE.	

DURING TEMPORARY SLOPE PIPE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Verify that the geotextile is not damaged during placement.	
☐	Ensure that the metal end sections are installed per PUB 408 Section 616 specifications.	
☐	Confirm that the pipe allows proper water flow.	
☐	Verify that the pipe connections are tightly secured.	
☐	Ensure that erosion is minimized at the discharge area.	

AFTER TEMPORARY SLOPE PIPE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure pipes and end sections are removed and disposed of properly when they are no longer required.	

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Material & Equipment

The material used for the work includes a metal end section, pipe (inlet and outlet), fill slope pipe, and Class 4 Type A geotextile.

The contractor uses excavation and compaction equipment such as a vibratory plate compactor or mini vibratory roller, in installing the slope pipe drain.

Mechanical:				
Excavator	Mini Vibratory Roller	Vibratory Plate Compactor		
Hand Tools:				
Rake	Shovel			

Construction Methods

The contractor constructs a berm of compacted embankment material along the work area if required. The metal end section is installed at the inlet end to channel the flow of water into the temporary pipe. The pipe is installed and anchored to the slope at the length required to reach a suitable discharge area.

Geotextile is placed at the discharge area of the pipe and secured in place. Rock may also be placed, if necessary, to prevent erosion.

Measuring & Payment Methods

Temporary slope pipe drains are paid for as an each item.

G. PUMPED WATER FILTER BAG (SEC. 855)

This subsection addresses the furnishing, installing, maintaining, and disposing of a pumped water filter bag in accordance with PUB 408 Section 855.

☐ Review  Documentation Required

BEFORE PUMPED WATER FILTER BAG CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ES.13.FBAG.	
☐	Review PUB 888 Chapter 4.5.	

DURING PUMPED WATER FILTER BAG CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Verify that the filter bag is placed according to plans on a level surface using No. 57 aggregate to level as required.	MCDocs
☐	Confirm that a maximum of one pump discharge hose is securely attached to the filter bag, verifying a maximum pump rate as specified by the manufacturer.	
☐	Ensure that the discharge does not cause erosion at the outlet.	

AFTER PUMPED WATER FILTER BAG CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure filter bag and sediment are disposed of satisfactorily.	

Material & Equipment

The material used includes a pumped water filter bag from a manufacturer listed in PUB 35 Bulletin 15, Class 4 Type A geotextile, and AASHTO No. 57 aggregate.

The equipment used to place the pumped water filter bag includes tri-axle dump trucks and excavators to level and place the aggregate bedding.

Mechanical:				
Excavator	Submersible Pump	Tri-Axle Dump Truck		
Hand Tools:				
Rake	Shovel			

Construction Methods

Locate the bag in a well-vegetated area and discharge it onto a stable, erosion-resistant area. If the bag is placed in a high-quality or exceptional-value watershed, as indicated on the E&S plan, a compost berm or filter sock is installed.

If a well-vegetated area is not available, Class 4 Type A geotextile is placed to line the flow path to a receiving water course or well-vegetated area.

Monitor pumping operation for bag functionality and replace filter bag when flow is reduced by 50 percent or more due to diminished bag capacity.

Measuring & Payment Methods

A pumped water filter bag is paid for as an each item, including removal.

H. ROCK BARRIER (SEC. 856)

This subsection addresses the construction, maintenance, and removal of a rock barrier for channel and slope protection.

☐ Review  Documentation Required

BEFORE ROCK BARRIER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ES.4.RFOT.	
☐	Review PUB 888 Chapter 4.5.	

DURING ROCK BARRIER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Ensure that there are minimum voids during rock placement.	
☐	Verify that the rock barrier is constructed to be equal in height to one-half the total depth of the channel, with a depression of 6 inches in the center of the flowline per PUB 72M RC Standard 73M.	

AFTER ROCK BARRIER CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that inspections are conducted weekly and after each runoff event to determine if aggregate must be replaced or if any repairs are necessary.	
☐	Ensure that the contractor removes any accumulated sediment per PUB 408 Section 856.	

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Material & Equipment

Material for the work includes Class R-4 rock and No. 57 coarse aggregate.

In constructing the rock barrier, the contractor uses a bulldozer, front end loader, backhoe, dump truck, and excavation equipment.

Mechanical:				
Backhoe	Bulldozer	Dump Truck	Excavator	Front End Loader
Hand Tools:				
Rake	Shovel			

Construction Methods

The rock barrier must be constructed as shown on construction plans and drawings.

The contractor determines the required length of the ditch or depression slope.

The rock barrier is constructed to be equal in height to $\frac{1}{2}$ the total depth of the channel. Rock pieces are evenly distributed with minimum voids. Coarse aggregate is used to construct a filter blanket, as shown on construction plans and standard drawings. The top of the rock barrier is then tapered to the depth specified, with a depression in the center of the flowline.

Measuring & Payment Methods

Rock is paid by the square yard or cubic yard.

Coarse aggregate is paid by the cubic yard.

Removal of sediment and rock barriers is paid as each item.

I. CONCRETE BLOCK REVETMENT SYSTEMS (SEC. 857)

This subsection addresses the construction of an articulating system of interlock pre-cast concrete blocks or cable-connected pre-cast concrete block mats for erosion protection of slopes and channels in accordance with PUB 408 Section 857.

☐ Review  Documentation Required

BEFORE CONCRETE BLOCK REVETMENT SYSTEMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Confirm that the area is satisfactorily prepared prior to placing the geotextile.	

DURING CONCRETE BLOCK REVETMENT SYSTEMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Ensure that the geotextile is placed in an unstretched condition so as not to tear or damage the material.	
☐	Verify that the geotextile is securely anchored.	
☐	Confirm that the concrete block systems are properly placed and securely anchored in the slope per plans, the manufacturer's instructions, and PUB 408 Section 857 specifications.	MCDocs
☐	Ensure that the backfill material is placed as indicated.	
☐	Ensure that backfilling is completed within seven days of placing the geotextile.	
☐	If the aggregate is used as backfill, ensure that the size of the aggregate is per the manufacturer's recommendations and contract plans.	
☐	Verify that unsound or damaged blocks are not used.	

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☐		Task	Reference
☐		Ensure field samples are submitted to the Laboratory Testing Section (LTS) to verify that the specified type of geotextile is installed.	
☐		Confirm the application of seeding, soil supplements, and mulch as per PUB 408 Section 804 specifications.	

AFTER CONCRETE BLOCK REVETMENT SYSTEMS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials used in the work include pre-cast concrete blocks, stainless steel cable (used for connected block systems), geotextile, soil anchors, backfill, and aggregate. If directed, topsoil, seeding and soil supplements, mulch, and an erosion control mulch blanket are also used.

In constructing the concrete block revetment system, the contractor uses a backhoe, bulldozer, and compaction equipment, such as a vibratory steel wheel roller.

Mechanical:				
Backhoe	Bulldozer	Vibratory Steel Wheel Roller		
Hand Tools:				
Rake	Shovel			

Construction Methods

The contractor prepares and excavates the area by removing obstructions, including tree roots, large stones, or debris, to a depth specified below the subgrade. The slope area is graded to provide a smooth surface. Any voids or soft areas are backfilled with suitable material and compacted. Fine grading is performed in areas as needed before placing the geotextile.

Geotextile is placed on the prepared area, as specified, and is anchored or secured by acceptable methods. Concrete blocks are placed over the geotextile according to the manufacturer's instructions, contract plans, and specifications.

Cable-connected concrete block systems are secured to the slope with soil anchors, as indicated. After the blocks are placed, open areas of the block are backfilled with topsoil or aggregate to the top of the blocks, as indicated. Backfilling must be completed within seven days of placing the geotextile.

Measuring & Payment Methods

Concrete block revetment systems are paid by the square yard, as field-measured.

If aggregate backfill is used, payment is incidental to the work.

Seeding and soil supplements, mulching, rolled erosion control products, and topsoil (if used) are payable as per PUB 408 Sections 802, 803, 804, 805, and 806.

J. GEOCELL CONFINEMENT SYSTEM (SEC. 858)

This subsection addresses furnishing and maintaining a geocell confinement system for slope erosion protection in accordance with PUB 408 Section 858.

☐ Review  Documentation Required

BEFORE GEOCELL CONFINEMENT SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Confirm that the area is satisfactorily prepared prior to placing the geotextile.	
☐	Ensure that the geocell confinement sections are kept unexpanded until the time of installation.	

DURING GEOCELL CONFINEMENT SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Ensure that the geotextile is placed in an unstretched condition so as not to tear or damage the material.	
☐	Verify that the geotextile is securely anchored.	
☐	Confirm that the geocell confinement sections are placed onto the geotextile by expanding the material with its longer dimensions parallel to the slope direction, up and down.	
☐	Ensure that the geocell sections are installed flush or slightly lower than the adjacent final grade and anchored in place, as indicated.	MCDocs
☐	Verify that the adjacent sections of the geocell are properly fastened.	
☐	Confirm that the backfill is placed flush with the top of the cells, as indicated.	

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☐		Task	Reference
☐		Ensure that the contractor does not operate equipment on geocell sections or uncompacted material; only compaction equipment is permitted.	
☐		Confirm the application of seeding, soil supplements, and mulch as per PUB 408 Section 858 specifications.	

AFTER GEOCELL CONFINEMENT SYSTEM CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure that the geocell confinement systems are properly maintained (regrading, replacing fill material, reseeding, and mulching) until the completion of the project.	

Material & Equipment

Materials for the work include stakes, fasteners, No. 2A or 67 coarse aggregate (as indicated), and Class 4 Type A non-woven geotextile. In addition, topsoil, seeding, soil supplements, and mulch are also used.

In constructing a geocell confinement system, the contractor uses a bulldozer, loader, dump truck, and compaction equipment, such as a vibratory steel wheel roller.

Mechanical:				
Bulldozer	Dump Truck	Front End Loader	Vibratory Steel Wheel Roller	

Construction Methods

The contractor prepares the area by clearing large rocks, vegetation, and debris, then grading the surface smooth. The geotextile is then placed on the prepared area in a loose, unstretched condition, as specified. The geotextile is anchored or secured by an acceptable method, such as with securing pins or aggregate.

Geocell confinement sections are placed on the geotextile by expanding the material with its longer dimensions parallel to the slope direction, up and down. Sections should be flush or slightly lower than the adjacent final grade and anchored in place, as indicated.

Backfill is placed flush with the top of the cells and compacted. Seeding, soil supplements, and mulch are then applied as indicated.

Measuring & Payment Methods

Geotextile confinement systems are paid by the square yard. The unit price includes backfill as indicated. Geotextile is paid by the square yard.

Seeding and soil supplements are paid as indicated in PUB 408 Section 804, while mulch is paid according to PUB 408 Section 805.

K. SEDIMENTATION POND, CLEANING SEDIMENTATION STRUCTURES, SEDIMENT TRAP: EMBANKMENT, SEDIMENT TRAP: RISER, SEDIMENT BASIN, CONCRETE OUTLET STRUCTURE (SEC. 859, 861, 870, 871, 872, & 875)

This subsection addresses the construction of a dam to impound water in a storage area and the removal and disposal of sediment deposited in the sedimentation control device. A sediment pond and sediment trap impound water in a storage area.

Sedimentation Pond

The settling pond incorporates a controlled stormwater release structure to collect and store sediment produced by construction activities. The pond has a riser and pipe outlet with a spillway to slow the release of runoff and provide sediment filtration. By removing sediment, the pond helps to prevent clogging of offsite conveyance systems and to control sediment loadings in receiving waterways. Refer to PUB 408 Section 859 for more information.

Cleaning Sedimentation Structures

Cleaning of sedimentation structures involves the removal and disposal of sediment deposited in E&S control structures or devices. Refer to PUB 408 Section 861 for more information.

Sediment Trap

A sediment-collecting trap allows sediment to settle out of the runoff. The trap incorporates an outlet or spillway constructed of aggregate to slow the release of runoff. A sediment trap is most often used at the outlets of stormwater diversion structures, channels, slope drains, or any other runoff conveyance that discharges waters containing erosion sediment and debris. Refer to PUB 408 Sections 870 and 871 for more information.

Sediment Basin

A sediment-collecting basin allows sediment to settle out of the runoff. The basin is located in a permanent stormwater management facility that incorporates a concrete outlet structure and spillway. Refer to PUB 408 Section 872 for more information.

Concrete Outlet Structure

This work also includes the removal or conversion to a permanent stormwater management facility where a permanent concrete outlet structure is constructed. Refer to PUB 408 Section 875 for more information.

A licensed professional must be on-site at all times while the work during the critical stages is completed, as detailed in the Post Construction Stormwater Plan (PCSM) plan.

☐ Review  Documentation Required

BEFORE SEDIMENTATION POND, CLEANING SEDIMENTATION STRUCTURES, SEDIMENT TRAP: EMBANKMENT, SEDIMENT TRAP: RISER, SEDIMENT BASIN, CONCRETE OUTLET STRUCTURE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review PUB 464 Section ES.17.STB.	
☐	Review PUB 888 Chapter 4.5.	

DURING SEDIMENTATION POND, CLEANING SEDIMENTATION STRUCTURES, SEDIMENT TRAP: EMBANKMENT, SEDIMENT TRAP: RISER, SEDIMENT BASIN, CONCRETE OUTLET STRUCTURE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐	Ensure that the crest of the emergency spillway for a sediment pond is constructed at the specified height above the top of the riser.	
☐	Verify that the anti-seep collar and its connections to the pipe are watertight.	
☐	Confirm that the pipe is backfilled with suitable embankment material to prevent dam leakage along the pipe. Coarse aggregate should not be used as backfill material around the pipe.	
☐ 	Ensure that the embankment is compacted in layered lifts.	
☐	Verify that the embankment is stabilized as directed in PUB 408 Section 804 and is seeded and mulched if required.	
☐	Confirm that care is taken not to damage the geotextile material during placement.	

AFTER SEDIMENTATION POND, CLEANING SEDIMENTATION STRUCTURES, SEDIMENT TRAP: EMBANKMENT, SEDIMENT TRAP: RISER, SEDIMENT BASIN, CONCRETE OUTLET STRUCTURE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure that the sediment trap is frequently inspected to ensure that it is draining properly and that there is no damage from erosion.	
☐ 	Verify that the depth of the spillway is checked and maintained at the minimum distance specified below the low point of the trap embankment.	
☐	Confirm that accumulated sediment is removed when it reaches a point 1/3 of the depth of the sediment structure or device to prevent erosion into construction areas or nearby waterways.	
☐	Ensure that the structure or device is not damaged during sediment removal.	
☐ 	Verify that the sediment was disposed of in an approved manner or per the E&S control plan.	
☐	Confirm that the site is reconditioned by filling in excavated areas and removing embankments, riser pipe assemblies, corrugated metal pipe, and anti-seep collars and that all areas specified are restored when the sedimentation pond or trap is no longer required, or if otherwise directed.	

Material & Equipment

Materials used in sediment pond and sediment basin construction include embankment, Class A concrete, a riser pipe assembly, corrugated metal pipe, plywood, and an anti-seep collar. If specified, seeding, soil supplements, and mulch are also used.

The contractor uses excavation equipment for constructing the dam and concrete testing equipment.

For cleaning sediment structures, the contractor uses loading and hauling equipment to remove and dispose of sediment, including backhoes, excavators, gradalls, and dump trucks.

Mechanical:				
Backhoe	Bulldozer	Dump Truck	Excavator	Front End Loader
Gradall	Vibratory Steel Wheel Roller			

Hand Tools:				
Rake	Shovel			
Testing/Inspection:				
Concrete Testing Equipment				

Construction Methods

Sedimentation Pond

Prior to constructing the sedimentation pond or sediment basin, the contractor performs any necessary clearing and grubbing of the storage area and embankment foundation site. A key trench is excavated the full length of the dam, and an emergency spillway is excavated in natural, undisturbed ground. The pipe spillway is then installed at the location indicated, with the anti-seep collar attached as specified.

The footing for the riser pipe is constructed using Class A concrete, as specified. The contractor's certified technician tests the concrete as specified in PUB 408 Section 704. The pipe is then backfilled with suitable embankment material. A rock basin is constructed at the outlet end of the pipe, and embankment material is placed as specified. If required, seeding, soil supplements, and mulch are applied.

Cleaning Sedimentation Structures

Cleaning of a sediment structure is required when accumulated sediment reaches a point 1/3 of the depth of the sediment structure or device. The contractor removes and disposes of the sediment. During the operation, the contractor should not damage the structure or device. Waste must be disposed of in an approved manner.

Sediment Trap

Prior to constructing the trap, the contractor clears and grubs the site, if required. The contractor then excavates for the construction of the trap and for forming embankments, as shown on the plans. Class 3 Type B geotextile, as specified, is used to line the sediment trap. A stone outlet comprised of placed aggregate or rock is then constructed at the discharge point. After the sediment trap is completed, seeding, soil supplements, and mulch are placed, if required.

Sediment Basin

A sediment basin is used for compacting embankment. If the sediment basin is converted to a permanent stormwater management basin, sediment is removed to the final contours as indicated, stabilized, and temporary devices are removed.

Concrete Outlet Structure

When a concrete outlet structure is required for a stormwater management facility, such as a sediment trap or basin, the foundation and walls are placed monolithically with a fabricated trash rack attached. The walls and bottom will accommodate any new or existing outlet pipes or weirs. If the concrete outlet structure is used for a temporary sediment trap or basin riser, temporary orifice cover plates will be installed and sealed to be leak-tight. When the temporary orifice cover plates are no longer needed, remove the plates and seal all holes in the structure that were installed for temporary purposes with non-shrink mortar and/or silicone sealant.

Measuring & Payment Methods

Class 1 excavation, borrow excavation, and rock are paid by the cubic yard. Plywood extensions, anti-seep collar, rock basin, and concrete outlet structure are paid for by each. The riser pipe assembly is paid as a lump sum. The corrugated metal pipe is paid for by the linear foot.

Refer to PUB 408 Section 206 regarding payment for embankments. If seeding and soil supplements are necessary, payment calculations are outlined in PUB 408 Section 804. Refer to PUB 408 Section 805 for payment of mulch; Section 703 for payment of aggregate; Section 850 for payment of rock; Section 851 for payment of rock basin; and Section 212 for payment of geotextiles.

Sediment removal and disposal are paid in cubic yards. The removed sediment is usually measured by the number of full loads hauled multiplied by the rated capacity of the hauling equipment in cubic yards. Cross sectional measurements are used for large quantities and when hauling equipment is not used.

L. STORM INLET PROTECTION (SEC. 860)

This subsection addresses the furnishing, installation, and maintenance of storm inlet protection of the type indicated in accordance with PUB 408 Section 860.

☐ Review  Documentation Required

BEFORE STORM INLET PROTECTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 Section ES.5.INLT.	
☐	Review PUB 888 Chapter 4.5.	

DURING STORM INLET PROTECTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Verify that the inlet protection specified in the plans is installed. Inlet protection types are not interchangeable.	MCDocs
☐ 	Ensure that the aggregate is placed at the specified dimensions and depths per contract plans and PUB 408 Section 860 specifications.	MCDocs
☐ 	Complete E&S reviews of the installed Best Management Practices (BMPs) weekly and after each storm event of more than ¼ inches of rainfall using the VSIR app, noting any deficiencies.	VSIR

AFTER STORM INLET PROTECTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Ensure that the inlet filter bags are replaced and properly disposed of when the flow rate decreases due to accumulated sediment or as specified.	
☐		Confirm that when the concrete block/gravel or pipe/gravel inlet protection aggregates become full of sediment or are washed out, the gravel is replaced.	

Material & Equipment

Material for the work includes inlet filter bags, precast concrete block, wire or plastic mesh, wood studs, No. 57 coarse aggregate, PVC pipe, embankment, and/or sandbags.

Equipment used includes flatbed trucks and hand tools, such as rakes and shovels.

Mechanical:				
Flatbed Truck				
Hand Tools:				
Rake	Shovel			

Construction Methods

Inlet filter bags, concrete block/gravel, and pipe/gravel inlet protection are installed at the locations shown on the plans in accordance with the manufacturer's recommendations. When indicated, construct the downstream earthen or sandbag berm. Replace or remove and clean the inlet filter bag when sediment has accumulated to 1/3 full or when capacity has been reduced to cause water to bypass the inlet. Remove and replace aggregate when it is contaminated with sediment or washed out. Remove and dispose of inlet protection upon completion of the work.

Measuring & Payment Methods

Inlet filter bags, concrete block/gravel, and pipe/gravel inlet protection are paid for as each item.

M. DIVERSION DITCH (SEC. 864)

This subsection addresses the construction of a ditch to divert surface runoff water in accordance with PUB 408 Section 864.

☐ Review  Documentation Required

BEFORE DIVERSION DITCH CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

DURING DIVERSION DITCH CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm the application of seeding, soil supplements, and mulch as per PUB 408 Section 804.	
☐	Verify that a windrow is constructed with excavated material on the low side of the ditch to minimize overflow.	
☐	Ensure that the diversion ditch has an adequate runoff outlet to a point where water outflow will not cause damage.	
☐	Confirm that the diversion ditch is protected from damage from construction activities.	

AFTER DIVERSION DITCH CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Obtain the seed tags.	

Material & Equipment

Material used in the work includes seeding, soil supplements, and mulch.

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The equipment used to construct the diversion ditch includes dump trucks, excavators, or gradalls. The diversion ditch is seeded using a hydroseeder or hand spreaders.

To complete the work, the contractor uses excavation and compacting equipment and hand tools such as rakes, shovels, and a vibratory steel wheel roller.

Mechanical:				
Excavator	Gradall	Hydroseeder	Mulch Blower	Seed Spreader
Tri-Axle Dump Truck	Vibratory Plate Compactor	Vibratory Steel Wheel Roller		
Hand Tools:				
Rake	Shovel			

Construction Methods

The contractor uses excavated material to construct a windrow on the low side of the ditch, which is then compacted with a heavy wheel load or other acceptable compaction method.

Soil supplements, seeding, and mulch are applied to the entire ditch area, as specified in PUB 408 Sections 804 and 805.

Measuring & Payment Methods

Diversion ditch construction is paid for by the linear foot.

N. SILT BARRIER FENCE, HEAVY DUTY SILT BARRIER FENCE, COMPOST FILTER SOCK, COMPOST BLANKET AND COMPOST FILTER BERM (SEC. 865, 866, 867, & 868)

This subsection addresses the construction of silt barrier fencing. These stormwater perimeter controls are fencing used to control excessive silt runoff from areas where the soil is disturbed during construction.

Silt Barrier Fence

A silt barrier fence for the height indicated typically consists of Class 3 geotextile, mesh supports, and posts with 18-inch embedment into the ground. If guy wires are specified, ensure ground anchors are installed in accordance with the PUB 72M RC Standard 70M and PUB 408 Section 865.

Heavy Duty Silt Barrier Fence

Silt barrier fence for the height indicated typically consists of Class 3 geotextile, mesh supports, and steel or aluminum posts with 36-inch embedment into the ground. Refer to PUB 408 Section 866 specifications for more information.

Compost Filter Sock

Compost filter sock of the diameter specified consists of a filter sock meeting the requirements of the DEP Erosion and Sediment Pollution Control Program Manual as shown in PUB 408 Section 867 Table A and filled with a well-decomposed, stable, weed-free, organic compost derived from agriculture, food, stump grindings, and yard or wood/bark organic matter sources.

Compost Blanket & Compost Filter Berm

A compost filter blanket or berm consists of a well-decomposed, stable, weed-free, organic compost derived from agriculture, food, stump grindings, and yard or wood/bark organic matter sources for the sedimentation pollution control system. Refer to PUB 408 Section 868 specifications for more information.

☐ Review

 Documentation Required

BEFORE SILT BARRIER FENCE & COMPOST FILTER SOCK, BLANKET, & FILTER BERM CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Review PUB 464 Sections ES.2.SILT, ES.3.SSF, ES.15.CFS, and ES.16.CFB.	
☐		Review PUB 888 Chapter 4.5.	

DURING SILT BARRIER FENCE & COMPOST FILTER SOCK, BLANKET, & FILTER BERM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the posts are securely installed.	
☐	Verify that the silt fencing is erected in a continuous fashion to eliminate unwanted gaps along the ground line.	
☐ 	Confirm that there is minimal sagging of the fencing material during installation.	
☐ 	Ensure that the silt fencing installation follows specifications and the manufacturer's recommendations, which also include any necessary overlapping.	MCDocs
☐ 	Verify that the compost filter sock and filter berm are installed on a level contour with edges turned 45 degrees for an 8-foot upslope.	
☐ 	Confirm that the BMPs are installed at the approved locations in accordance with the E&S plans. If changes are needed, notify the IIC.	MCDocs
☐ 	Complete E&S reviews of the installed BMPs weekly and after each storm event of more than ¼ inches of rainfall using the VSIR app, noting any deficiencies.	VSIR

AFTER SILT BARRIER FENCE & COMPOST FILTER SOCK, BLANKET, & FILTER BERM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Obtain the seed tags.	
☐	Ensure that the silt fencing is inspected for tears or gapping and repaired or replaced as necessary.	
☐	When no longer needed (i.e., 70% uniform growth), verify that the silt fencing and compost filters are removed, and the area is restored to its original condition.	

Material & Equipment

Material for the silt barrier and heavy-duty silt barrier fence includes Class 3 Type A or B geotextile as specified, wire mesh, posts, and hardware.

The material for the compost filter sock includes the sock and compost. Material for the compost blanket and compost filter berm includes compost and seed.

The contractor uses equipment such as a small trenching machine, pneumatic blower equipment, hydroseeder, seed spreaders, shovels, and hand tools, as well as compaction equipment.

Mechanical:				
Hydroseeder	Seed Spreader	Trencher		
Hand Tools:				
Pneumatic Blower	Rake	Shovel		

Construction Methods

Silt Barrier & Heavy-Duty Silt Barrier Fence

For the silt barrier and heavy-duty silt barrier fence, the contractor installs the posts and attached mesh support, then excavates a trench at level grade per plans. Geotextile fabric is then installed and attached securely to the mesh support as indicated. The trench is backfilled to bury the bottom of the fabric and compacted.

Compost Filter Sock

For the compost filter sock, the contractor places the sock downslope of the earth disturbance on a level contour as indicated in the plans and fills the sock with compost. The ends of the sock are turned at least 8 feet upslope at 45 degrees to maintain alignment. Stakes are also driven into the filter sock at 10-foot intervals.

Compost Blanket

For the compost blanket, the contractor will scarify the soil surface with appropriate equipment and remove unworkable soil clumps, debris, large rocks, and stumps. The compost is uniformly applied to the specified depth. Seed is applied to the compost stream during compost application.

Compost Filter Berm

For the compost filter berm, the contractor will apply the compost with a pneumatic blower and a berm forming and shaping device. Construct the berm downslope of the earth disturbance on a level contour as indicated in the plans. The ends of the berm are turned at least 8 feet upslope at 45 degrees to maintain alignment. The berm is trapezoidal, 2 feet high and 4 feet wide.

Periodically clean up the sediment buildup behind these devices.

Measuring & Payment Methods

Silt barrier fence, heavy-duty silt barrier fence, compost filter sock, and compost filter berm are paid for by the linear foot.

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If silt barrier fence or heavy duty silt barrier fence replacement is required, the Department will pay for it at the contract unit price.

The compost blanket is paid for by the square yard and includes seeds if specified.

O. WORKING AROUND STORMWATER CONTROL MEASURES

This subsection addresses the contractor's responsibilities in working around Stormwater Control Measures (SCMs), such as existing wetlands, sedimentation ponds, or other filtration or infiltration systems.

In Pennsylvania, wetlands are regulated by the Dam Safety and Encroachments Act (25 Pa. Code Chapter 105), which reviews all water-related activities to protect and conserve the natural resources of the Commonwealth, and the federally regulated United States Clean Water Act, which regulates discharges of pollutants into the waters of the United States. Current state and federal regulations of the Pennsylvania DEP, the United States Army Corps of Engineers, and the United States Environmental Protection Agency are largely based on our improved understanding of construction activities' impacts on stormwater runoff and wetland functions.

☐ Review  Documentation Required

BEFORE WORKING AROUND SCMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 .	
☐	Review PUB 888 .	
☐	Ensure that the necessary permits or approvals are obtained from regulatory agencies.	MCDocs
☐	Verify that the setbacks from wetlands, riparian areas, and surface waters are provided.	MCDocs
☐ 	Confirm that all changes to the E&S plan (BMP location, sequencing, etc.) are approved prior to implementation.	MCDocs
☐	Ensure that barriers are placed to prevent the encroachment of equipment within protected areas.	

DURING WORKING AROUND SCMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that during any construction project involving activities near wetland areas, the identified areas are properly fenced or otherwise	MCDocs

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☐ 	Task	Reference
	identified in advance on the site to properly delineate and define wetlands to ensure they are protected.	
☐	Verify that impacts on wetlands and waters are avoided or minimized to the maximum extent possible during the construction project.	
☐	Confirm that fencing is used as a simple means of protecting wetlands.	
☐ 	Ensure that the buffer zone around a wetland is fenced off as an extra protection measure. Buffer zones are vegetated strips of land used for temporary or permanent water quality benefits. They are used to decrease the velocity of stormwater runoff, which helps to prevent soil erosion. Buffer zones can be newly planted or comprise an area or strip of vegetation that is left undisturbed during construction.	
☐	Verify that equipment, construction materials, topsoil, and fill dirt are not placed within protected areas.	
☐	Confirm that the open spaces, vegetated natural buffers, and riparian areas are retained.	
☐	Ensure that preventive construction techniques (minimal impact development) and careful site management are employed to minimize the impact of construction activities on existing vegetation and wetlands.	
☐ 	Complete E&S reviews of the installed BMPs weekly and after each storm event of more than ¼ inches of rainfall using the VSIR app, noting any deficiencies.	VSIR

AFTER WORKING AROUND SCMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure that the project E&S measures are implemented and maintained to ensure continued, effective operation.	MCDocs
☐	Ensure that the buffer zones are protected. These measures protect against disturbances such as grade changes, excavation, damage from equipment, and other activities. These measures also help protect the wetland vegetation in adjacent buffer zone areas.	

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Material & Equipment

No materials are used for this operation.

No equipment is used to complete this work.

Construction Methods

There are no construction methods for this operation.

Measuring & Payment Methods

There are no measuring and payment methods for this operation.

P. WORKING IN STREAM CHANNELS

This subsection addresses working in stream channels.

Dams, water obstructions, and encroachments in bodies of water in the Commonwealth, including wetlands, are regulated by state and federal statutes. The United States Army Corps of Engineers regulates these activities under the authority of the Clean Water Act 404 Permit Program. The Pennsylvania DEP regulates these activities under the authority of the Dam Safety and Encroachment Act's Chapter 105 Permit Program. County Conservation Districts may be delegated to administer parts of this program by granting certain types of permits for water encroachment, performing inspections, and other activities. Activities and structures in or near a regulated stream or its adjacent floodway are included in this program. A regulated stream is any channel with a defined bed and banks that can convey water.

The objective of the federal Clean Water Act (CWA) is “to restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” To achieve this goal, the CWA prohibits the discharge of dredged or fill material into the waters of the United States unless a permit issued by the Army Corps of Engineers or an approved state under CWA Section 404 authorizes such a discharge.

The contractor must perform any indicated work in a waterway in accordance with the requirements of any permits or approvals issued by any governing agencies. The contractor is not permitted to conduct any work in a waterway before obtaining the required permits or approvals.

☐ Review  Documentation Required

BEFORE WORKING IN STREAM CHANNELS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 464 .	
☐	Ensure that all E&S control measures are implemented before any work begins.	
☐	Verify that the contractor does not begin any work in a stream until the necessary permits or approvals are obtained from the Army Corps of Engineers, the Pennsylvania DEP, the Pennsylvania Department of Conservation and Natural Resources, and the Pennsylvania Fish and Boat Commission.	
☐	Confirm that all required permits are filed on the project in paper format before any work begins.	

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☐		Task	Reference
☐		If working in a stream will in any way affect or disrupt fish life, verify that the Pennsylvania Fish and Boat Commission is given sufficient advanced notice.	
☐		If possible, ensure that work is scheduled for low-flow seasons.	

DURING WORKING IN STREAM CHANNELS CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure that the contractor conducts work in waterways according to permit requirements.	MCDocs
☐		Verify that the contractor's equipment does not encroach on waterways.	
☐		Confirm that the contractor limits the equipment and vehicles used to the minimum necessary to complete the operation.	
☐		Ensure that if excavation occurs in a stream channel, a backhoe, clam bucket, dragline, or other equipment capable of working outside the existing channel is used.	
☐		Verify that any in-channel excavations are performed from the top of the banks, wherever possible. At locations where this is not possible, verify that a temporary crossing or causeway is provided for any equipment working from within the channel prior to any stream encroachment.	
☐		Confirm that the contractor dries any wet material excavated from a stream channel to an acceptable moisture content for embankment construction if it is determined to be a suitable material.	
☐		Ensure that any excavated channel materials that will later be used as backfill are placed in a temporary stockpile located outside the channel.	
☐		Verify that any hazardous or pollutive materials used, such as fuels, oils, or bitumens, are stored in a location such that the waterway will not be subject to an accidental spill or release of contaminated substances.	
☐		Confirm that any pumped water from excavated areas is filtered prior to discharge into waterways.	

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☐		Task	Reference
☐		Ensure that all disturbed areas within the existing channel are completed and stabilized before the flow is redirected into the channel.	
☐		Verify that all E&S measures are maintained and inspected according to the permit requirements.	

AFTER WORKING IN STREAM CHANNELS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that upon completion of work, the area is stabilized and restored per specifications.	

Material & Equipment

No materials are used for this operation.

No equipment is used to complete this work.

Construction Methods

There are no construction methods for this operation.

Measuring & Payment Methods

There are no measuring and payment methods for this operation.

REFERENCES

Approved Erosion and Sediment Control Plan - MCDocs

Approved Quality Control Plan – [PPCC](#)

Clean Water Act 404

Dam Safety and Encroachments Act (25 Pa. Code Chapter 105)

Pennsylvania's DEP's Chapter 102 Erosion and Sedimentation Control

Post Construction Stormwater Plan (PCSM) Plan - MCDocs

[PUB 2](#) Project Office Manual

- Part B, Section 4 Health, Safety, and Environment

[PUB 35](#) Qualified Products List for Construction (Bulletin 15)

[PUB 72M](#) Roadway Construction Standards

- RC Standard 70M (Perimeter Control Devices)
- RC Standard 71M (Sediment Basin and Sediment Trap)
- RC Standard 72M (Inlet and Outlet Protection)
- RC Standard 73M (Channel and Slope Protection)
- RC Standard 74M (Temporary Diversions)
- RC Standard 75M (Dewatering Devices)
- RC Standard 76M (Straw Bale Barrier)
- RC Standard 77M (Rock Construction Entrance)
- RC Standard 78M (Slope Pretection Geocell Cell and Geocell Section Details)
- RC Standard 91M (Bracing and Planting Details)
- RC Standard 92M (Removal Limits of Tree Trimming)

[PUB 213](#) Temporary Traffic Control Guidelines

[PUB 408](#) Highway Construction Specifications

- Section 105 (Control of Work)
- Section 107 (Legal Relations and Responsibility to the Public)
- Section 110 (Payment)
- Section 201 (Clearing and Grubbing)
- Section 203 (Class 1, Class 1A, Class 1B, and Class 1C Excavation)
- Section 206 (Placement and Compaction of Embankment and Fill)
- Section 212 (Geotextiles)
- Section 616 (End Sections and Slope Pipe Fittings)
- Section 703 (Aggregate)
- Section 704 (Cement Concrete)
- Section 801 (Stockpiling Topsoil or Topsoil Mixture)
- Section 802 (Topsoil Furnished and Placed)
- Section 803 (Placing Stockpiled Topsoil or Topsoil Mixture)
- Section 804 (Seeding and Soil Supplements)
- Section 805 (Mulching)
- Section 806 (Rolled Erosion Control Products)
- Section 808 (Plants, Planting, and Transplanting)
- Section 809 (Sodding)

Section 800: Roadside Development

- Section 810 (Tree Trimming and Selective Tree Removal)
- Section 811 (Temporary Protective Fence)
- Section 845 (Unforeseen Water Pollution Control)
- Section 849 (Rock Construction Entrance)
- Section 850 (Rock Lining)
- Section 851 (Outlet Protection: Rock)
- Section 852 (Paved Energy Dissipator)
- Section 854 (Temporary Slope Pipe)
- Section 855 (Pumped Water Filter Bag)
- Section 856 (Rock Barrier)
- Section 857 (Concrete Block Revetment Systems)
- Section 858 (Geocell Confinement System)
- Section 859 (Sedimentation Pond)
- Section 860 (Storm Inlet Protection)
- Section 861 (Cleaning Sedimentation Structures)
- Section 864 (Diversion Ditch)
- Section 865 (Silt Barrier Fence)
- Section 866 (Heavy Duty Silt Barrier Fence)
- Section 867 (Compost Filter Sock)
- Section 868 (Compost Blanket and Compost Filter Berm)
- Section 870 (Sediment Trap – Embankment)
- Section 871 (Sediment Trap – Riser)
- Section 872 (Sediment Basin)
- Section 875 (Concrete Outlet Structure)
- Section 1001 (Cement Concrete Structures)

[PUB 464](#) Maintenance Field Reference for Erosion and Sediment Controls

- Section ST.1.SEED (Seeding)
- Section ST.2.TPSL (Topsoil)
- Section ST.6.ECB (Erosion Control Blanket (ECB))
- Section ST.7.TRM (Turf Reinforcement Mat (TRM))
- Section ES.2.SILT (Silt Barrier Fence)
- Section ES.3.SSF (Super Silt Fence)
- Section ES.4.RFOT (Rock Filter Outlet)
- Section ES.5.INLT (Storm Inlet Protection)
- Section ES.8.PIPE (Temporary Slope Pipe)
- Section ES.9.OUTL (Outlet Protection)
- Section ES.11.LING (Channel Linings)
- Section ES.13.FBAG (Pumped Water Filter Bag)
- Section ES.14.RCE (Rock Construction Entrance)
- Section ES.15.CFS (Compost Filter Sock)
- Section ES.16.CFB (Compost Filter Berm)
- Section ES.17.STB (Sediment Traps and Basins)

[PUB 888](#) Stormwater Control Measure Maintenance Manual

- Chapter 4.2 Routine Maintenance
- Chapter 4.5 Disposal of Sediment Removed from SCMs
- Chapter 6.10 Outfall Protection

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SECTION 900: TRAFFIC ACCOMMODATION & CONTROL

GOALS

- Ensure proper installation and functionality of traffic control devices like signs, signals, pavement markings, and barriers.
- Ensure traffic control is implemented and maintained in a safe manner to protect workers and the traveling public.

TRAFFIC ACCOMMODATION & CONTROL SAFETY

- **Traffic Control:** Properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** A construction site has many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Weather Conditions:** Know the weather conditions each day and prepare for current and changing weather conditions.
- **Personal Protective Equipment (PPE):** Wear proper PPE when working near construction operations.
- **Electric Safety:** Comply with the local government, the electric utility company, and state codes or requirements; the electrical regulations of the Department of Labor and Industry; and the construction requirements of the National Electrical Code and National Electric Safety Code.

1. MAINTENANCE & PROTECTION OF TRAFFIC DURING CONSTRUCTION (SEC. 901)

This section addresses the furnishing, installing, maintaining, and relocating of traffic control devices. This work may include flagging and pilot car operation for guidance of traffic through the temporary traffic control zone and dust control. All work shall be done per PUB 408, PUB 212, PUB 213, the Manual on Uniform Traffic Control Devices (MUTCD), special provisions, standard drawings, the approved traffic control plans (TCP), and as directed. Maintenance and Protection of Traffic (MPT) is associated with all aspects of roadway and bridge construction projects.

☐ Review  Documentation Required

BEFORE MPT DURING CONSTRUCTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Establish the MCMPT app for MPT device compliance inspections, referring to PUB 2 Part C.9 for inspection frequencies of short- and long-term setups and detours.	MCMPT
☐ 	Verify temporary barrier meets all specifications for the type of barrier indicated as specified in PUB 408 Section 627. Barriers should arrive at the site stamped by the manufacturer's inspector.	
☐ 	Verify flagger training certifications for all flaggers are per PUB 408 Section 901.3.	
☐	Confirm potential drop-off areas will be properly addressed per the plans and PUB 408 Section 901.	

DURING MPT DURING CONSTRUCTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Check the initial traffic control setup used to install devices for the project. The contractor may need to utilize PUB 213 Short-Term Stationary and/or Mobile PATAs if occupying the roadway or shoulder while placing devices. Verify the correct PATA is used for site conditions.	

Section 900: Traffic Accommodation & Control

☐		Task	Reference
☐		Verify the MPT devices are placed in accordance with approved methods and safety procedures for workers and road users according to PUB 213 .	
☐		Ensure the temporary barrier is set in the direction of traffic.	
☐		Verify top and side delineators are installed on the temporary barrier per PUB 111 TC Standard 8604.	
☐		Confirm the serviceability of MPT devices being installed. All devices shall be in acceptable or marginal condition per PUB 213 Appendix C and should not be placed if in unacceptable conditions.	
☐		Upon completion, ensure that all MPT devices have been installed according to the MPT plan, verifying all permanent traffic signs that conflict with temporary traffic signage have been removed or covered with material specified in PUB 408 Section 901.3 and conflicting pavement markings have been eradicated.	

AFTER MPT DURING CONSTRUCTION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure compliance inspections of long-term MPT devices are performed at least twice daily after initial setup and any phase/stage change where traffic is maintained through the construction zone and documented in MCMPT.	MCMPT
☐		Verify road closed signs are posted daily and detour signings at least twice a week, documenting in MCMPT.	MCMPT
☐		Confirm nighttime MPT devices are checked per PUB 2 Part C.9.2.	
☐		Ensure the initial traffic control setup is checked throughout the day when traffic is maintained through an area where MPT devices are installed and removed daily, and document it in PSA in accordance with PUB 2 Part C.9.2.	
☐		Document deficiencies that require corrective action by the contractor, the date/time of contractor notification, and the date/time that corrective action was made by the contractor.	
☐		Verify correct treatment is used as per PUB 408 Section 901.3, where drop-off conditions exist.	

Section 900: Traffic Accommodation & Control

☐		Task	Reference
☐		Review traffic control set up periodically throughout the day or night for compliance or if adjustments need to be made based on traffic flow and complete MCMPT.	MCMPT

Material & Equipment

The barrier used is the pre-cast type indicated in PUB 72M RC Standards 57M, 58M, and 59M. The pre-cast barrier is made of AAA concrete, meeting the requirements of PUB 408 Section 704. New barriers should arrive at the site stamped by the manufacturer's inspector. If the barrier is not new and the stamp is not visible, the barrier is accepted only by certification and if it meets the requirements outlined in PUB 2 Part B.6.

The contractor needs a gradall or a small crane to set the barrier into position, as well as a tape measure or a measuring wheel to lay out the barrier end transition locations.

Mechanical:				
Barrier Lift	Crane	Flatbed Truck	Line Painting Truck	Telehandler
Water Blaster				
Testing/Inspection:				
Camera	Measuring Wheel			

Construction Methods

Install and maintain traffic control devices as indicated on the TCP or an approved alternate plan submitted at the pre-construction conference. Provide safety for the general public and work crew and protection of work as per PUB 408 Section 901.3.

Measuring & Payment Methods

Payment for the MPT item will be in a proportionate manner based on current estimates per PUB 408 Section 901.4.

When other devices are indicated to be used for MPT, they will be paid separately, as indicated in PUB 408 Section 901.4.

2. HIGHWAY LIGHTING & SIGN LIGHTING (SEC. 910 & 920)

This section addresses the furnishing, installation, erection, and wiring of highway lighting and sign lighting systems.

Highway Lighting

Highway lighting work includes furnishing and installing electrical power supply and distribution systems.

Sign Lighting

Sign lighting work includes furnishing and installing complete electrical distribution, control, and illumination systems.

☐ Review  Documentation Required

BEFORE HIGHWAY LIGHTING & SIGN LIGHTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and quality control (QC) plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Confirm foundation excavations are approved prior to the continuation of foundation construction.	
☐	Ensure delivered materials comply with approved submittals.	

DURING HIGHWAY LIGHTING & SIGN LIGHTING CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	Ensure foundation excavations are approved prior to the continuation of foundation construction and verify anchor bolt pattern is per PUB 72M RC Standard 80M or contract drawings.	
☐	Verify light poles are set plumb and that the length of the arms is per shop drawings.	

Section 900: Traffic Accommodation & Control

☐		Task	Reference
☐		Perform all required highway and sign lighting tests per PUB 408 Section 910, complete forms CS-4225A , CS-4225B , CS-4225C , CS-4225D , CS-4225E , and CS-4225G , and attach them to the Project Site Activity (PSA).	
☐		Ensure all conduit marks are set according to the project plan and PUB 72M RC Standards 80M, 81M, 82M, 83M, and 84M, and PUB 111 TC Standard 8715.	
☐		Verify the service pole is set within the right-of-way (ROW) and the locations shown on the plan.	
☐		Confirm all work is performed according to the specifications of PUB 408 Sections 910 and 920, PUB 72M RC Standards 80M, 81M, 82M, 83M, and 84M, and PUB 111 TC Standard 8715.	

AFTER HIGHWAY LIGHTING & SIGN LIGHTING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure all testing data is submitted to the Inspector-in-Charge (IIC) and completion dates for installations for warranty reference are recorded.	
☐		Verify installation heights of all overhead signs and lighting fixtures.	
☐		Confirm and record the date the system is fully operational and monitor the system through the 168-hour performance test and the 180-day guarantee period.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The materials required for highway lighting and sign lighting are project-specific and shown on the project highway lighting plan. Materials required to perform this work are listed in PUB 408 Sections 910, 920, 1101, 1102, PUB 72M RC Standards 80M through 84M, and PUB 111 TC Standard 8715. Materials must meet the specifications of these applicable sections of PUB 408, PUB 72M, and PUB 111.

Section 900: Traffic Accommodation & Control

The contractor may need a backhoe or a trencher to excavate junction boxes and conduit trenches. A truck-mounted power auger is needed to excavate for light pole foundations. Small compaction equipment, such as a mechanical tamper, is needed to compact the trench backfill.

Surveying instruments to lay out and establish grades for light pole foundations and service pole locations are needed. Equipment to test the concrete used for pole foundations and a level to plum light poles are also needed. Testing equipment to perform voltage and lux (foot-candle) readings and other system component tests is needed.

Mechanical:				
Aerial Lift	Air Compressor	Backhoe	Pavement Saw	Radial Boom Derrick
Trencher	Tri-Axle Dump Truck	Truck Mounted Power Auger	Vibratory Plate Compactor	Winch
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Screed	Shovel	Trowel	
Testing/Inspection:				
Concrete Testing Equipment	Lux Meter	Measuring Wheel	Probe Thermometer	Smart Level
Survey Rover	Survey Transit	Surveying Rod		

Construction Methods

Highway Lighting

The contractor lays out the new highway lighting per the project highway lighting plan. The contractor then excavates for light pole foundations and conduit trenches and excavates and places junction boxes per the project plan.

Light pole foundations are placed as shown on the PUB 72M RC Standard 80M standard series for the type indicated. If concrete is used in the foundations, the contractor's certified concrete technician tests the concrete in accordance with PUB 408 Section 704 and documents the placement in the eConcrete app. Ground rods are tested, and results are documented prior to placing concrete. The conduit is then placed and backfilled as per PUB 72M RC Standard 84M for the number and size indicated.

The wire is then pulled through the conduits run to the junction boxes and main power supply. All electrical wiring and testing are done per PUB 408 Section 910, 920, 1101, and 1102 and PUB 72M RC Standard 84M. Light poles and luminaries are set according to plan and PUB 72M RC Standard 83M. Testing of system components is performed per PUB 408 Section 910.

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Sign Lighting

The contractor augers or excavates holes for sign lighting service poles at the locations shown on the plan and places the service poles. The contractor then excavates for the conduit, places junction boxes on the sign structure, and pulls the wire through the conduit.

Sign lighting is placed according to the plan and PUB 111 TC Standard 8715. The contractor connects the power supply and performs all tests as specified in PUB 408 Section 910. Conduit markers are placed as shown on the plan and per PUB 72M RC Standard 84M.

Measuring & Payment Methods

Most highway lighting items are paid as each as outlined in applicable sections of PUB 408. These are paid completely on a PSA after placement.

Cable, trenches, conduit, conduit sleeve, and pull wire are paid by the linear foot. These items are field-measured and paid on a PSA.

The complete power supply is paid as each after installation.

Testing of the entire lighting system is paid in a lump sum after all testing is completed.

Sign lighting is paid as a lump sum item. Payment includes costs associated with labor, equipment, and electrical energy needed for testing.

3. POST-MOUNTED SIGNS (SEC. 930, 931, 932, 933, 934, & 935)

This section addresses the installation of posted mounted signs. There are six types of posted mounted signs:

Type A

Fabricated aluminum signs on steel “S” or “W” beam posts with breakaway systems



Type B

Flat sheet signs on breakaway steel posts



Type C

Flat sheet signs on wooden posts



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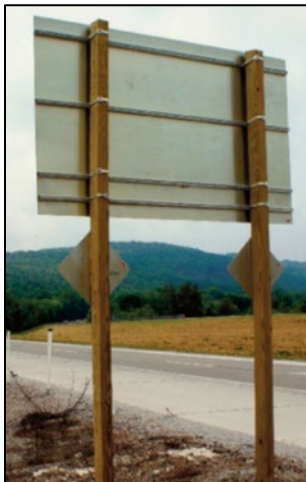
Type D

Flat sheet aluminum signs with stiffeners on steel pipe supports.



Type E

Fabricated aluminum signs on wood or composite posts



Type F

Signs on existing posts or posts installed for other purposes. See the applicable photo above.

Most Type A signposts are mounted in a Class A concrete foundation that incorporates rebar. The Class A concrete used for the sign foundations must meet the requirements of PUB 408 Section 704, be supplied from an approved concrete batch plant, and be batched from an approved mix design. Prior to placement, the contractor's certified concrete technician tests the concrete to ensure it is within specifications.

The rebar used in the sign foundation must meet the requirements of PUB 408 Section 709. After the cement and rebar are placed, the concrete must be cured.

☐ Review  Documentation Required

BEFORE POST-MOUNTED SIGNS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure signs were manufactured per plans and PUB 46 , PUB 236 , and PUB 111 TC Standards 8702A, 8702B, 8702C, 8702D, and 8702E specifications.	
☐	Confirm the sign fabrication for Type A signs has been approved.	

DURING POST-MOUNTED SIGNS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure traffic is maintained through the construction zone and documented in MCMPT.	MCMPT
☐ 	Verify reflective sheeting is not damaged during sign erection.	
☐	Confirm signs and posts do not have twists, bends, and other damage before and after erection.	
☐	Ensure anti-theft hardware is used when required.	
☐ 	Verify the contractor scribes the month, day, and year of installation on the back of the signs as specified in PUB 408 Sections 930, 931, 932, 933, 934, and 935.	
☐	Confirm the sign type is the size and legend shown on the plan or approved drawing.	
☐	When concrete is placed, ensure the concrete is finished flush with the adjacent ground and in a way that prevents standing water against the post.	

Section 900: Traffic Accommodation & Control

☐		Task	Reference
☐		Confirm reinforcing steel is free of defects.	
Type A Signs			
☐		Ensure the contractor lays out the location of the sign as shown on the plan drawings, marks the finished grade on offset stakes for the sign foundations, and excavates the sign foundations to the dimensions required for the sign per PUB 111 TC Standard 8702A.	
☐		Verify rebar and Class A concrete is then placed in the foundation.	
☐		Confirm construction meets the specifications of PUB 408 Section 930 and PUB 111 TC Standard 8702A.	
Type B Signs			
☐		Ensure the contractor lays out the location of the signs as shown in the plan drawings or as directed, meeting the requirements of PUB 111 TC Standard 8702B.	
☐		If required, verify the contractor drills the hole for the sign; hole size is determined by the size of the post and the chart shown on PUB 111 TC Standard 8702B.	
☐		Confirm the contractor then drives the anchor posts to the required depth, attaches the sign, and mounts the sign to the post per PUB 111 TC Standard 8702B.	
Type C Signs			
☐		Ensure the contractor lays out the location for the post foundation at the location shown on the plan. The foundation is then excavated to the dimensions shown on the standards for the sign per PUB 111 TC Standard 8702C.	
☐		Verify the contractor places the treated wood post (with shim plates and bars attached) in the sleeve in the excavated foundation as shown on the standards for the sign type; Class A concrete is placed in the foundation.	
☐		After the concrete has cured, confirm the contractor mounts the sign according to PUB 408 Section 932 and PUB 111 TC Standard 8702C.	
Type D Signs			

Section 900: Traffic Accommodation & Control

☐		Task	Reference
☐		Ensure Type D signs are flat aluminum signs with stiffeners on street pipe supports, fastened to fabricated structural steel mounting brackets per PUB 111 TC Standard 8702D.	
☐		Verify the contractor lays out the location of the sign and mounting bracket hole pattern. The holes are then drilled, and the approved adhesive anchors are placed. The post is mounted to the mounting bracket, and the sign is mounted to the post.	
☐		Confirm the Type D sign mounting bracket is the system shown on standards or a system submitted by the contractor and approved by the Department.	
☐		Ensure the Type D sign mounting bracket, pipe, and sign stiffeners meet the requirements of PUB 111 TC Standard 8702D.	
Type E Signs			
☐		Ensure Foundations for the treated wood sign posts are excavated to the dimensions shown on PUB 111 TC Standard 8702E and the sign is mounted as specified.	
Type F Signs			
☐		Ensure Type F signs are signs installed on existing posts or posts installed for other purposes.	
☐		Verify the contractor mounts the signs by attaching them to supports on the standard drawings for post-mounted sign Types A, B, C, D, or E, as appropriate, and is mounted per PUB 408 Section 935.	

AFTER POST-MOUNTED SIGNS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		At the conclusion of the construction activities, daily and at job completion, ensure all traffic patterns are removed and traffic is restored to normal flow, if applicable.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Types A & B Signs

Materials used to construct the Type A and B signs must meet the requirements listed in PUB 408 Sections 930 and 931, respectively.

The contractor may use a truck-mounted power auger or a backhoe to excavate the foundations of Type A signs. A small crane may be needed to erect the signs on the posts. The contractor needs a survey instrument to lay out Type A sign locations and set elevations for the top of the sign foundations, as well as to level the vertical post for the sign. If the sign is to be placed on existing pavement, the contractor may need equipment to drill through concrete or asphalt pavement. The contractor also needs hand tools to drive the post and erect the sign, as well as a level to plumb the vertical post. A measuring device, such as a measuring wheel, is used to establish the location of the signs.

Type C & E Signs

The materials required to manufacture and erect Type C signs are outlined in PUB 408 Section 932 and must meet the requirements of PUB 111 TC Standard 8702C. Materials required to fabricate and install Type E signs are listed in PUB 408 Section 934 and must meet the requirements of PUB 111 TC Standard 8702E.

The contractor needs a power auger or a backhoe capable of excavating footings to the dimensions shown on the standards for the sign type. The contractor also needs hand tools to erect the sign and post or a lift to erect the sign. Survey instruments are used to lay out sign locations and set grades for the footings. A level is used to plumb vertical posts.

Types D & F Signs

The materials required to manufacture and install Type D signs must meet the requirements outlined in PUB 408 Section 933 and PUB 111 TC Standard 8702D. The materials required to fabricate and install Type F signs must meet the requirements of PUB 408 Section 935.

The contractor needs drilling equipment and hand tools to erect Type D signs and a level to plumb the vertical posts. For Type F signs, the contractor needs hand tools to mount the sign to an existing post, as well as a tape measure to establish the mounting height of the sign.

Mechanical:				
1800 Pound Single-Axle Vehicle	Air Compressor	Backhoe	Concrete Drill	Crane
Front End Loader	Power Auger			
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Sprayer	Concrete Vibrator
Ladder	Ratchet	Shovel	Trowel	Wrench

Testing/Inspection:				
Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level	Tape Measure

Construction Methods

The installation of the type of sign indicated on the plans is in accordance with PUB 408 Sections 930, 931, 932, 933, 934, and 935 and PUB 111 TC Standards 8702A, 8702B, 8702C, 8702D, and 8702E.

Type A Signs

The contractor lays out the location of the sign as shown on the plan drawings and marks the finished grade on offset stakes for the sign foundations. The contractor then excavates the sign foundations to the dimensions required for the sign per PUB 111 TC Standard 8702A. Rebar and Class A concrete are then placed in the foundations. After the concrete has cured, the contractor places the vertical post on breakaways mounted to the foundations per PUB 111 TC Standard 8702A, then mounts the sign to the post per standards. The area around the sign is restored per plan requirements.

Type B Signs

The contractor lays out the location of the signs as shown in the plan drawings or as directed, meeting the requirements of PUB 111 TC Standard 8702B. If required, the contractor drills the hole for the sign; the hole size is determined by the size of the post and the chart shown on PUB 111 TC Standard 8702B. The contractor then drives the anchor posts, attaches the sign, and mounts the sign to the post per PUB 111 TC Standard 8702B.

Types C & E

The contractor lays out the location for the post foundation at the location shown on the plan. The foundation is then excavated to the dimensions shown on the standards for the sign type. The contractor places the post (with shim plates and bars attached) in the sleeve in the excavated foundation, as shown on the standards for the sign type. Class A concrete is placed in the foundation. After the concrete has cured, the contractor mounts the sign according to the applicable PUB 408 Sections 932 and 934 and PUB 111 TC Standards 8702C and 8702E. After the erection of the signs is complete, the area is restored as indicated on the plan drawings.

Type D Signs

All work must be completed according to PUB 111 TC Standard 8702D. The contractor lays out the location of the sign and mounting bracket hole pattern. Holes are drilled, and the approved adhesive anchors are placed. The post is mounted to the mounting bracket, and the sign is mounted to the post.

Type F Signs

The contractor mounts the signs by attaching them to supports as shown on the standard drawings for post-mounted signs Type A, B, C, D, or E, as appropriate. The sign is mounted per PUB 408 Section 935.

Measuring & Payment Methods

Type B, C, E, and F signs are paid by square foot for the sign size shown on the plan. The unit price includes the removal of existing signs and the erection of posts.

Type A signs are paid by the square foot of the sign area, which includes the removal of the existing and the erection of the post. It does not include the steel post or W-beam post and the breakaway system.

Steel posts or W-beam posts are paid per pound.

The breakaway system is paid per each.

Type D signs are paid by the square foot of the sign area. It does not include furnishing and erecting fabricated structural steel mounting brackets.

4. STRUCTURE-MOUNTED SIGNS (SEC. 936)

This section addresses the furnishing and installation of signs of the Type indicated, mounted on overhead structures.

☐ Review  Documentation Required

BEFORE STRUCTURE-MOUNTED SIGNS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Review PUB 111 TC Standards 8701A, 8701D, 8701E, 8701P, 8701R, 8701S, and 8701W.	
☐	Ensure signs were manufactured per plans and PUB 111 TC Standards 8701A, 8701D, 8701E, 8701P, 8701R, 8701S, and 8701W specifications.	

DURING STRUCTURE-MOUNTED SIGNS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the sign is mounted level and erected in a manner that does not twist, bend, or deform the sign and is in accordance with PUB 111 TC Standards 8701A, 8701D, 8701E, 8701P, 8701R, 8701S, and 8701W and PUB 408 Sections 930, 936, 1103, and 1105.	
☐ 	Verify that the lowest point of any sign over the roadway is not less than 17 feet above the roadway surface unless otherwise specified on the approved plans.	

AFTER STRUCTURE-MOUNTED SIGNS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The materials used for the fabrication and mounting of signs, such as flat sheet aluminum and fabricated structural steel, must meet the requirements of PUB 408 Sections 930, 936, 1103, and 1105 and PUB 111 TC Standards 8701A, 8701D, 8701E, 8701P, 8701R, 8701S, and 8701W.

The contractor may need a lift to access the mounting area, and a crane may be needed to lift the mounting brackets and sign. The contractor also needs a level to ensure that the sign is mounted horizontally.

Mechanical:				
Aerial Lift	Bucket Truck	Crane		
Hand Tools:				
Ratchet	Wrench			
Testing/Inspection:				
Smart Level	Tape Measure			

Construction Methods

The contractor removes the existing sign (if required) and erects that type of sign indicated per PUB 408 Sections 930, 936, 1103, and 1105 and PUB 111 TC Standards 8701A, 8701D, 8701E, 8701P, 8701R, 8701S, and 8701W. The sign is mounted level and erected in a manner that does not twist, bend, or deform the sign.

Measuring & Payment Methods

Structure-mounted signs are paid by the square foot, based on the measurement of the sign, not to exceed the standard or plan dimensions unless authorized. The unit price includes the removal of the existing signs and mounting hardware.

5. TRAFFIC SIGNAL SYSTEMS & COMMUNICATION (SEC. 953)

This section addresses the furnishing and installation of operational traffic signals, including controller assemblies, traffic signal supports, electrical distribution systems, traffic signals, heads, detectors, and communications systems.

☐ Review  Documentation Required

BEFORE TRAFFIC SIGNAL SYSTEMS & COMMUNICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review PUB 148 TC-8800 Series.	
☐	Review the MPT plan for temporary signals.	MCDocs
☐	Ensure there is a traffic signal permit.	

DURING TRAFFIC SIGNAL SYSTEMS & COMMUNICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure all catalog cuts, drawings, and manufacturer's specifications are approved for all signal materials.	
☐	Verify foundation excavations prior to the continuation of foundation construction and that the anchor bolt pattern is as per contract drawings.	
☐	Confirm poles are set plumb.	
☐	Ensure the service pole is set within the ROW and the locations shown on the plan.	

AFTER TRAFFIC SIGNAL SYSTEMS & COMMUNICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Within three weeks after notice to proceed, the contractor submits a tabulation of all traffic signal project materials to the Department for review and acceptance. This includes the type of materials, manufacturers, model numbers, and the Department's certificate of approval number for each item to be supplied as per PUB 408 Section 950 and warranties. Catalog cuts may be required for further clarification when requested by the Department. All materials must meet the requirements of PUB 408 Section 950 and PUB 111 TC Standard 7800.

The contractor needs excavating equipment, such as a backhoe or a track excavator, to excavate the foundation for signal poles per PUB 111 TC Standard 7800. The contractor also needs a small crane to erect signal poles, signal arms, and signal heads; a lift may also be necessary to erect signal heads. Survey instruments are used to lay out the location of the signal pole and to establish the final finish grade on top of the pole foundation. The contractor also needs concrete testing equipment, meeting the requirements of PUB 408 Section 704, to test the concrete placed in the signal pole foundation.

Mechanical:				
Aerial Lift	Backhoe	Crane	Excavator	Radial Boom Derrick
Trencher	Tri-Axle Dump Truck	Truck Mounted Power Auger	Vibratory Plate Compactor	
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Ladder	Ratchet	Screed	Shovel
Trowel	Wrench			
Testing/Inspection:				
Concrete Testing Equipment	Lux Meter	Measuring Wheel	Probe Thermometer	Smart Level

Section 900: Traffic Accommodation & Control

Survey Rover	Survey Transit	Surveying Rod		

Construction Methods

The contractor lays out the location for the signal per plan. The layout is verified by the District Signal Unit prior to excavating. The contractor then excavates the footer to the required elevation and places rebar and anchor bolts per PUB 111 TC Standard 7800. The concrete of the class required in the foundation is then placed. After the required cure period, the contractor erects the pole and places the signal head. The contractor then sets the control cabinet, electrical supply, and all other equipment required by the plans and PUB 111 TC Standard 7800.

After installation is completed, a 24-hour operating test is performed for 30 consecutive days. For traffic control systems, conduct a separate 30-day test on the entire system after the individual intersections 30-day tests. The contractor is responsible for the in-service guarantee for a 180-day operational support period.

Measuring & Payment Methods

The removal and storage of existing traffic signal material, the restoration of areas damaged by construction, and testing are incidental to the work specified in PUB 408 Sections 951, 952, 953, 954, 955, and 956.

A. TRAFFIC SIGNAL SUPPORTS (SEC. 951)

This subsection addresses the furnishing and installation of complete and operational traffic signs and systems for the mounting of traffic controls, devices, and luminaries.

☐ Review  Documentation Required

BEFORE TRAFFIC SIGNAL SUPPORTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review PUB 111 TC Standard 7800.	

DURING TRAFFIC SIGNAL SUPPORTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the Department has approved changes in location due to obstructions and other conditions.	
☐ 	Verify foundation excavations prior to the continuation of foundation construction.	
☐	Confirm the foundation is constructed per PUB 111 TC Standard 7801 for the type of support indicated on the plan.	
☐	Ensure concrete sets properly before the installation of supports (72-hour minimum).	
☐	Verify the vertical alignment of the shaft and the alignment of the mast after the signal is in place.	

AFTER TRAFFIC SIGNAL SUPPORTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	At the conclusion of the construction activities, daily and at job completion, ensure all traffic patterns are removed and traffic is restored to normal flow, if applicable.	
☐ 	Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Class A concrete required for the signal foundations must be supplied from an approved concrete batch plant and mixed from an approved mix design. All other materials required to place the signal supports are listed in PUB 408 Section 951 and must meet the requirements of the section and PUB 111 TC Standard 7801.

The contractor needs excavating equipment, such as a track excavator or a backhoe, capable of excavating the foundation to the dimensions required for the type indicated and as shown on PUB 111 TC Standard 7801. The contractor also needs a small crane to place the signal pole and the mast arm.

Survey instruments are used to establish the location of the signal pole and to establish finish grades for the top of the pole foundation. Concrete testing equipment, meeting the requirements of PUB 408 Section 704, is used to test the concrete placed in the signal foundations.

Mechanical:				
Backhoe	Bucket Truck	Concrete Mixer Truck	Concrete Saw	Crane
Excavator	Skid Steer	Tri-Axle Dump Truck	Vibratory Plate Compactor	Vibratory Steel Wheel Roller
Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Hammer	Hand Tamper	Rake	Shovel
Trowel				

Section 900: Traffic Accommodation & Control

Testing/Inspection:				
Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level	Tape Measure

Construction Methods

The contractor lays out the location of the signal pole per the project plan. Foundation grades are set on offset stakes, and the contractor excavates for the foundation per PUB 111 TC Standard 7801. The contractor then places rebar and anchors bolts.

Prior to placing concrete, the contractor's certified concrete technician tests the concrete per specifications. If acceptable, the concrete is placed per PUB 111 TC Standard 7801.

After the concrete has cured, the contractor backfills around the foundation per PUB 408 Section 951. The pole and mast arm are set, as indicated, and the signal is installed per the plan and PUB 111 TC Standard 7801. After installation is complete, the contractor restores the construction area as indicated on the plan and PUB 408 Section 951.

Measuring & Payment Methods

Traffic signal supports are paid as each for the type installed. After installation, these are marked paid completely on the PSA.

B. CONTROLLER ASSEMBLY & TRAFFIC SIGNAL SYSTEMS (SEC. 952)

This subsection addresses the furnishing and installation of a traffic signal controller assembly and the system equipment for the control of traffic signals.

☐ Review  Documentation Required

BEFORE CONTROLLER ASSEMBLY & TRAFFIC SIGNAL SYSTEMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review PUB 148 TC-8800 Series.	
☐	Ensure there is a traffic signal permit.	
☐	Verify the Department has approved the controller assembly.	

DURING CONTROLLER ASSEMBLY & TRAFFIC SIGNAL SYSTEMS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the controller assembly is installed per the plans, PUB 408 Section 952 and PUB 111 TC Standard 7802.	
☐ 	Verify all required tests have been performed on the controller assembly per PUB 408 Section 952 specifications.	
☐	Confirm all traffic signal system components are installed as indicated on the plan and approved by the Department.	
☐	Ensure all signal system work is performed per PUB 408 Section 953 and PUB 111 TC Standard 8800.	
☐	Verify that all system training has been performed as required.	

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☐		Task	Reference
☐		Confirm the traffic signal system is tested as outlined in PUB 408 Section 953.	

AFTER CONTROLLER ASSEMBLY & TRAFFIC SIGNAL SYSTEMS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		At the conclusion of the construction activities, daily and at job completion, ensure all traffic patterns are removed and traffic is restored to normal flow, if applicable.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The controller assembly material is listed in and must meet the requirements of PUB 408 Section 952. The controller cabinet must be approved as outlined in PUB 408 Section 950. Materials required for traffic signal systems are listed and must meet the requirements of PUB 408 Section 953.

If a concrete foundation is required, the concrete must be from an approved concrete batch plant and batched from an approved mix design. The concrete must also meet all of the requirements of PUB 408 Section 704 for the class indicated.

The contractor may need equipment, such as a backhoe, gradall, or track excavator, to excavate for controller cabinet foundations or poles, as well as to excavate conduit trenches per PUB 111 TC Standard 7801. The contractor also needs hand tools used to mount the controller cabinet per PUB 111 TC Standard 7802 and a small crane to set poles and mast arms and mount signals.

Survey instruments are used to lay out the location for the controller cabinet and establish finished grades for the concrete foundation if required. Concrete testing equipment, meeting the requirements of PUB 408 Section 704, is used to test the concrete placed in the concrete foundation.

Mechanical:				
Backhoe	Concrete Mixer Truck	Concrete Saw	Crane	Excavator
Gradall	Material Transfer Vehicle			

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Hand Tools:				
Concrete Broom	Concrete Bullfloat	Concrete Edger	Concrete Rake	Concrete Sprayer
Concrete Vibrator	Hammer	Hand Tamper	Rake	Shovel
Trowel				
Testing/Inspection:				
Concrete Testing Equipment	Measuring Wheel	Probe Thermometer	Smart Level	

Construction Methods

The contractor lays out the location for the controller cabinet as shown on the plan. If the cabinet is mounted on a concrete foundation, the contractor then excavates the foundation. The foundation must be constructed per PUB 111 TC Standard 7802.

The contractor then places the required conduit and ground rod. The ground rod is tested as specified in PUB 408 Section 910. Rebar and concrete are then placed in the foundation. Prior to placement, the contractor's certified concrete technician tests the concrete to ensure it is within specifications.

After the concrete has cured, the contractor mounts the cabinet and pole per plan and PUB 111 TC Standard 7802. The controller is put into operation and tested as outlined in PUB 408 Section 952.

The contractor lays out the location of the traffic signal system equipment per plan and PUB 111 TC Standards 7801 through 7805. The work is performed according to PUB 408 Section 953 and PUB 111 TC Standards 7801 through 7805.

After the installation of traffic signal systems, a 30-day operational test is conducted on the system. The contractor provides initial system training during the first week of the testing period and performs all tests required by PUB 408 Section 953.

Measuring & Payment Methods

Controller assemblies are paid as each once installed. Payment includes the required Buss Interface unit (BIU) and detector card rack assembly. This is marked paid completely on the PSA when installed.

If a time clock is incorporated, it is also paid as each on a PSA when installed.

Master controller assemblies are paid as each and marked paid completely on the PSA when installed.

System training is paid as a lump sum item after training is completed.

C. ELECTRICAL DISTRIBUTION & TRAFFIC SIGNAL COMMUNICATION (SEC. 954)

This subsection addresses the furnishing and installation of the electrical distribution service for the control and illumination of traffic signals and the equipment to provide communication between controller assemblies within a system.

☐ Review  Documentation Required

BEFORE ELECTRICAL DISTRIBUTION & TRAFFIC SIGNAL COMMUNICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review PUB 111 TC Standard 7804.	
☐	Ensure there is a traffic signal permit.	

DURING ELECTRICAL DISTRIBUTION & TRAFFIC SIGNAL COMMUNICATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the electrical distribution service meets the requirements shown on the plan, PUB 408 Section 954, and PUB 111 TC Standard 7804.	
☐ 	Inspect the electrical service as required by the utility company.	
☐	Check local requirements for electrical service installations.	
☐ 	Verify all required tests have been performed on the electrical distribution as specified in PUB 408 Section 954.	
☐	Confirm communication cables are spliced only at terminal ends and are tested per PUB 408 Section 954.	

AFTER ELECTRICAL DISTRIBUTION & TRAFFIC SIGNAL COMMUNICATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

The materials required to install the electrical distribution service are listed and must meet the requirements of PUB 408 Sections 950 and 954. The materials required for signal communications must meet the requirements of PUB 408 Section 953.

The contractor may need a power auger or other equipment to excavate for service per PUB 111 TC Standard 7804. The contractor also needs a backhoe, trencher, and vibratory plate compactor to excavate and backfill conduit trenches.

Survey equipment is used to lay out the location of the service as shown on the plan. Concrete testing equipment, meeting the requirements of PUB 408 Section 704, is used to test concrete placed in foundations, if required.

Mechanical:				
Backhoe	Power Auger	Trencher	Vibratory Plate Compactor	
Testing/Inspection:				
Survey Transit				

Construction Methods

The contractor lays out the location and installs the electrical distribution services as indicated on the project plan and PUB 111 TC Standard 7804. All conduits, grounds, and electrical wires are installed per PUB 408 Section 954, PUB 111 TC Standard 7804, and plan drawings. After installation, the contractor tests the signal wiring circuits as specified in PUB 408 Section 954.

Traffic signal communications components are laid out at locations as required by the plan. Installation is performed per PUB 408 Section 957 and PUB 111 TC Standard 7804.

Measuring & Payment Methods

Conduit, trench and backfill, and signal cable are paid by linear foot. The unit price includes cable, identification tags, and cable lashings. All of these items are field-measured and paid on a PSA.

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Junction boxes and electrical service are paid as each. Payment is made on a PSA after installation.

Control cables, communication cables, and instrument cables are paid for by the linear foot. These, too, are field-measured and paid on a PSA.

D. SIGNAL HEADS & DETECTORS (SEC. 955 & 956)

This subsection addresses the furnishing and installation of assemblies for the control and illumination of vehicular traffic or pedestrian signals and devices to sense the presence or passage of vehicles or pedestrians.

☐ Review  Documentation Required

BEFORE SIGNAL HEADS & DETECTORS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 111 TC Standards 7805 and 7806.	
☐	Ensure there is a traffic signal permit.	

DURING SIGNAL HEADS & DETECTORS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the signal heads are the ones indicated on the plan and as approved by PennDOT and are installed per PUB 408 Section 955 and PUB 111 TC Standard 7805.	
☐	Verify signals are covered with opaque material to hide signal indicators from traffic until the signal is put into operation.	
☐	Confirm the detector is installed as shown on the plan, PUB 408 Section 956, PUB 111 TC Standard 7806, and as approved by the Department.	
☐	Ensure all required signal and detector tests are performed as Perform all tests required as outlined in PUB 408 Sections 950 and 956.	

AFTER SIGNAL HEADS & DETECTORS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The material required for signal heads is listed in and must meet the requirements of PUB 408 Section 955. Materials required for detectors are outlined and must meet the requirements of PUB 408 Section 956.

The contractor may need a small crane and a lift to mount the signal heads. For installing detectors, the contractor needs a concrete saw capable of sawing pavement. The contractor also needs a rotary drill to drill through the curb to place the conduit, an air compressor to clean the saw cut before placing the sensor, and equipment and material to seal the saw cuts.

A tape measure or measuring wheel is used to lay out the location of the detector.

Mechanical:				
Aerial Lift	Bucket Truck	Core Drill	Crane	
Hand Tools:				
Pliers	Ratchet	Wrench		
Testing/Inspection:				
Tape Measure				

Construction Methods

The contractor installs the type of signal heads as shown on the plan and per PUB 408 Section 955 and PUB 111 TC Standard 7805 at the indicated locations. After installation, the contractor performs all required operational tests outlined in PUB 408 Section 950.

The contractor lays out the location of the detector and saw cuts the pavement per standards for the type indicated. The saw cut is cleaned per PUB 408 Section 956. The contractor then places the sensor wire and seals the pavement per PUB 408 Section 956 and PUB 111 TC Standard 7806.

Measuring & Payment Methods

Vehicular and pedestrian signal heads are paid as each when installed and operational. Payment is made on a PSA.

Section 900: Traffic Accommodation & Control

Detector lead-in cable and loop sensors are paid for by the linear foot. These items are field-measured and paid completely in a PSA. All other parts of the detector system are paid each when installed, with payments listed on a PSA.

6. PAVEMENT MARKINGS (SEC. 960, 962, 964, & 965)

This section addresses the furnishing and application of hot thermoplastic, preformed thermoplastic pavement markings, waterborne pavement markings, and reflectorized, two-component epoxy resin pavement markings with glass beads.

Hot Thermoplastic Pavement Markings

Hot thermoplastic pavement markings are hot melt marking paint that is heated and melted in a kettle, after which it is sprayed on the road surface. After cooling, the paint forms a thick polymer layer, which is wear-resistant, bright, and reflective.

Preformed Thermoplastic Pavement Markings

Preformed thermoplastic pavement markings are tape made from thermoplastic that is applied and typically used for crosswalks, lane turn legends, and other miscellaneous markings.

Waterborne Pavement Markings

Waterborne pavement markings are similar to all paints in that it is a thin layer of blended material that can be applied to different surfaces. Its greatest advantage over other types of traffic marking paints is its cost. It is one of the least expensive traffic marking materials available. Some of its other advantages include:

- It does not require solvents for cleanup. It can be flushed out with water and/or ammonia.
- It dries quickly in ideal conditions. Due to its quick drying time, it is ideal for use in jobs that require quick turnaround.
- It is eco-friendly. It is not considered hazardous waste in most areas.

Epoxy Resin Pavement Markings

Epoxy resin pavement markings are durable traffic paints designed for use in high-traffic volume areas where extended service life is desirable. Epoxy is a slow-drying, two-component material applied using a specially designed airless application.

☐ Review

 Documentation Required

BEFORE PAVEMENT MARKINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 111 TC Standard 8600.	
☐	Review the Pavement Marking Plan.	MCDocs
☐	Ensure the contractor has provided a schedule of operations at least five days before beginning work.	
☐	Verify application equipment meets the specifications of PUB 408 Sections 962 and 964.	

DURING PAVEMENT MARKINGS CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure retro-reflectivity testing is performed and meets the requirements established by a retro reflectometer.	
☐		Verify defective markings have been repaired or removed as determined by the Department.	
☐		Confirm legends are not applied with hand brushes or rollers.	
☐		After application, ensure the pavement markings are protected until sufficiently dry.	
Hot Thermoplastic Pavement Markings			
☐		Ensure the roadway is prepared per the manufacturer's recommendations and PUB 408 Sections 960 and 963.	
☐		Verify pavement markings are applied per PUB 408 Section 960.	
Preformed Thermoplastic Pavement Markings			
☐		Ensure the roadway is prepared per the manufacturer's recommendations and PUB 408 Sections 963 and 965.	
☐		Verify pavement markings are applied per the manufacturer's recommendations, PUB 408 Section 965, PUB 111 TC Standard 8600, and the project plan.	
Waterborne Markings			
☐		Ensure the IIC confirmed atmospheric and pavement conditions are suitable for the work.	
☐		Verify pavement markings are applied per the plan and PUB 408 Section 962.	
Epoxy Pavement Markings			
☐		Ensure the roadway is prepared per the manufacturer's recommendations and PUB 408 Section 964.	
☐		Verify pavement markings are applied at the thickness specified in PUB 408 Section 964.	

AFTER PAVEMENT MARKINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment**Thermoplastic Pavement Marking**

The materials and equipment used for hot thermoplastic pavement markings must be listed and meet the requirements of PUB 35 Bulletin 15 approved and PUB 408 Section 960.

The materials and equipment used for preformed thermoplastic pavement markings must be listed and meet the requirements of PUB 35 Bulletin 15 approved and PUB 408 Section 965.

The contractor needs equipment to prepare the roadway surface; this equipment is specified in the various PUB 408 sections listed above for the specific type of marking placed.

In applying hot thermoplastic and preformed thermoplastic pavement markings, the contractor must also use the manufacturer's required equipment and specifications.

A dry mil gauge to check the thickness of the placed markings to ensure that the pavement markings are within PUB 408 specifications.

Waterborne & Epoxy Pavement Markings

The materials and equipment required for waterborne pavement markings must meet the requirements of PUB 408 Section 962. The materials required for epoxy pavement markings must meet the requirements of PUB 408 Section 964 and must be from an approved source listed in PUB 35 Bulletin 15.

The contractor must also obtain specifications from the epoxy manufacturer regarding the proper mix ratios, proper temperatures, proper mixing techniques, and all other data required to apply the material correctly. The contractor must supply the IIC with four sample plates of each color: two plates with glass beads and two plates without glass beads. The sample pieces are used to check the thickness and reflexivity of the epoxy paint. Application equipment for epoxy pavement markings must meet all of the requirements of PUB 408 Section 964. If directed, the contractor may need equipment specified in PUB 408 Section 963 for preparing the pavement prior to applying markings.

The inspector needs a wet mil gauge to check the thickness of the waterborne markings to ensure that they meet the requirements of PUB 408 Sections 962 and 964.

Mechanical:				
Line Painting Truck	Thermoplastic Applicator			
Testing/Inspection:				
Dry Mil Gauge	Measuring Wheel	Tape Measure	Retroreflective Meter	Wet Film Thickness Gauge

Construction Methods

Thermoplastic Pavement Marking

Markings are laid out and approved by the department prior to placement.

The contractor prepares the area to receive the markings according to the PUB 408 Sections 960 and 965 and the manufacturer's recommendations, if applicable. Note: Grinding is only acceptable for the removal of thermoplastic, cold plastic, or epoxy marking materials; therefore, the contractor must obtain approval of the proposed removal method before starting any work.

To delineate locations for hot thermoplastic pavement markings, the contractor marks the pavement at 40-foot intervals. The IIC must review and accept the locations. Markings are applied according to the plan, PUB 408 Section 960, and the manufacturer's recommendations.

Preformed thermoplastic pavement markings are applied as indicated on the project plan, PUB 408 Section 965, and the manufacturer's recommendations. The contractor must guarantee the markings for 180 days from the date of acceptance.

A dry mil gauge is used to check the thickness of the placed markings to ensure that the pavement markings are within PUB 408 Section 963.

Waterborne & Epoxy Pavement Markings

At least five days before beginning work, the contractor must provide the IIC with a schedule of operations. The contractor must also supply the IIC with the manufacturer's instructions for the installation of the materials, application temperatures, proper mixing techniques, and any other information necessary to correctly complete the application. After markings are laid out, they are approved by the Department prior to placement.

For waterborne pavement markings, the contractor marks out the location of the new pavement markings by placing paint spots at 40 feet intervals. The contractor then applies the pavement markings as shown on the plan and per PUB 408 Section 962 specifications.

All paint applications, including protection of the painted surface, must follow the specifications of PUB 408 Section 962.

For epoxy pavement markings, the contractor prepares the pavement per PUB 408 Section 963 and as directed. The epoxy paint is applied using specified equipment operated by a certified technician as required by PUB 408 Section 964. After application, the contractor maintains protection from traffic until the epoxy paint is sufficiently dry to prevent dirt pickup or tracking.

Measuring & Payment Methods

Hot thermoplastic and preformed thermoplastic lines are paid by the linear foot and are field-measured and paid on a PSA.

Hot thermoplastic and preformed thermoplastic legends and typical legends (e.g., turning arrows or railroad crossing) are paid as each complete on a PSA after installation.

Waterborne pavement markings and epoxy pavement markings are paid for by the linear foot. The application truck is equipped with a calibrated measuring device, which automatically and continuously measures the length of each line placed. This measurement is the basis for payment, which is then shown on a PSA. This measurement can be spot-checked in the field using a calibrated measuring wheel.

A. PAVEMENT MARKING REMOVAL (SEC. 963)

This subsection addresses the removal of pavement markings and legends. A pavement marking removal operation is when existing markings are removed by grinding or water blasting.

☐ Review  Documentation Required

BEFORE PAVEMENT MARKING REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 111 TC Standard 8600.	
☐	Review the Pavement Marking Plan.	MCDocs
☐	Ensure the contractor has provided a schedule of operations at least five days before beginning work.	
☐	Verify the pavement marking removal method is approved prior to removal.	

DURING PAVEMENT MARKING REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the method used to remove pavement markings does not damage existing pavement, as outlined in PUB 408 Section 963.	
☐	Verify that residue created by the removal operation is removed from the roadway.	
☐	Confirm black paint is not used to cover existing lines.	
☐	Ensure pavement damage caused by the removal process is repaired.	
☐	Verify transverse and longitudinal joint seals are not damaged.	

AFTER PAVEMENT MARKING REMOVAL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The contractor may use a sandblaster, shot blaster, or water blaster to remove existing lines.

A grinder may be used to remove thermoplastic, cold plastic, or epoxy marking material. The contractor must obtain approval of the proposed removal method before beginning any of the work.

The contractor and the inspector need a measuring device to check the pavement surface after line removal to ensure the pavement is not grooved more than 1/32 inch. The inspector would also need a measuring wheel to measure the removal area.

Mechanical:				
Pavement Marking Grinder	Sand Blaster	Shot Blaster	Water Blaster	
Hand Tools:				
Heat Gun				
Testing/Inspection:				
Measuring Wheel	Surface Profile Gauge	Tape Measure		

Construction Methods

For pavement marking removal operations, the method must be approved. The IIC directs the contractor as to which lines or markings are to be removed.

The contractor may use a sandblaster, shot blaster, or water blaster to remove existing lines.

A grinder may be used to remove thermoplastic, cold plastic, or epoxy marking material. The contractor must obtain approval of the proposed removal method before beginning any of the work.

The contractor and the inspector need a measuring device to check the pavement surface after line removal to ensure the pavement is not grooved more than 1/32 inch. The inspector would also need a measuring wheel to measure the removal area.

The contractor is responsible for collecting and removing all roadway residues, including sand, dust, and marking material, created by the removal operation. Any damage caused by the removal operation should be repaired as required by the specifications.

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Measuring & Payment Methods

Removal of lines can be paid by the linear or square foot. The area is field-measured and paid on a PSA.

Legends removed are paid as each on a PSA after removal.

B. RECESSED WET-REFLECTIVE TAPE & POLYUREA PAVEMENT MARKINGS

This subsection addresses the furnishing and installing of preformed wet-reflective striping tape (tape) markings and polyurea resin (hot-sprayed) pavement markings of the color indicated in a recessed pavement surface and as specified in the contract documents and as directed by the representative.

Wet-Reflective Tape Pavement Markings

Wet-reflective tape pavement markings are designed to provide an improved level of retro-reflectivity during wet road surface conditions. Wet-reflective markings can be applied as a paint, tape, or thermoplastic material.

Wet-Reflective Polyurea (Hot-Sprayed) Pavement Markings

Wet-reflective polyurea pavement markings are applied using a hot-sprayed polyurea system.

☐ Review  Documentation Required

BEFORE RECESSED WET-REFLECTIVE TAPE & POLYUREA PAVEMENT MARKINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review Standard Special Provisions 9XXX (Recessed Wet-Reflective Tape Pavement Marking) and 9XXX (Recessed Wet-Reflective Polyurea Pavement Markings).	
☐	Review pre-application and pre-paint meeting minutes days prior to installation.	
☐	Review procedures for cutting grooves and installation.	

DURING RECESSED WET-REFLECTIVE TAPE & POLYUREA PAVEMENT MARKINGS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	The preparation of the surface and grinding operation are the same for the Wet-Reflective Tape and Polyurea application in accordance with Standard Special Provisions 9XXX and 9XXX. Ensure the	

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☐		Task	Reference
		pavement surface and joint areas have been checked for damage by the grinding operations.	
☐		Ensure any loose dirt and other debris are cleared from the area where the wet-reflective pavement markings will be applied.	
☐		Verify the grinding equipment is capable of producing a final pavement surface that is flat and free of ridges.	
☐		Confirm accurate placement of guide markings for all permanent pavement markings.	
☐		Ensure the recessed area is diamond cut to a depth of 90 to 110 mils and 1 inch wider than the width of the pavement marking, checking dimensions.	
☐		Verify the waste resulting from the grinding operations is properly disposed of.	
☐		Confirm markings are applied in the direction of traffic.	
Wet-Reflective Tape Pavement Markings			
☐		Ensure the surface temperature is 70F and rising, the ambient air temperature is 40F and rising, and the grooved surface is free of dirt and debris.	
☐		Verify adhesive is applied to the grooved surface and allow it to set per the manufacturer's directions.	
☐		Confirm tape is applied in the groove and tamp following Standard Special Provision 9XXX.	
Wet-Reflective Polyurea Pavement Markings			
☐		Ensure the road surface and ambient temperatures are 32F or higher unless otherwise approved by the Department Representative and acceptable to the manufacturer, and the pavement is dry and free of debris.	
☐		Verify pavement markings are applied by the following simultaneous operation: Option A: Triple Drop - First Drop: All-weather (AW) elements at a rate of 4 pounds per gallon - Second Drop: Visibead Plus II Highway Safety Marking Spheres or approved equal at a rate of 5 to 7 pounds per gallon.	

☐		Task	Reference
		- Third Drop: Standard glass beads at a rate of 5 to 7 pounds per gallon Option B: Double Drop - First Drop: AW elements at a rate of 4 pounds per gallon - Second Drop: Visibead Plus II Highway Safety Marking Spheres or approved equal at a rate of 10 to 12 pounds per gallon	

AFTER RECESSED WET-REFLECTIVE TAPE & POLYUREA PAVEMENT MARKINGS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The materials and equipment required for recessed wet-reflective tape pavement markings must meet the requirements of Standard Special Provision 9XXX and the manufacturer's recommendations. Provide a notarized copy of the manufacturer's certification, including the materials' date of manufacture and lot number. All tape markings and surface preparation adhesive shall only be installed by manufacturer-certified installers.

The materials required for recessed wet-reflective polyurea pavement markings must meet the requirements of Standard Special Provision 9XXX and must be from an approved source listed on PUB 35 Bulletin 15. The contractor must also obtain specifications from the polyurea manufacturer for instructions on use. These instructions are to include, but not be limited to, material mixing ratios and application temperatures (for the polyurea material and the pavement surface).

The contractor must supply the IIC with four sample plates of each color: Three plates with glass beads and one plate without glass beads or reflective optics. Provide the dry and wet retro-reflectivity levels of each sample.

Equip the grinding equipment with a free-floating cutting or grinding head to provide a consistent groove depth over irregular pavement surfaces. Equip the grinding or cutting head with gang-stacked diamond saw blades. The grinding equipment must be capable of producing a final pavement surface that is flat and free of ridges. For dry saw blade operation, clean and remove debris and dust from the entire roadway surface by self-contained vacuuming immediately after grinding. Only wet saw blade operation is permitted for use on concrete surfaces.

Application equipment for polyurea pavement markings must meet all the requirements of Standard Special Provision 9XXX. Provide a mobile applicator that is a truck-mounted, self-contained pavement marking machine specifically designed to apply polyurea resin materials and retroreflective optics in continuous and skip line patterns.

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Mechanical:				
Application Truck	Pavement Marking Grinder	Vacuum Truck		
Testing/Inspection:				
Dry Mil Gauge	Measuring Wheel			

Construction Methods

At least 30 days before beginning work, the contractor must coordinate a pre-application meeting with the IIC to review the requirements of the Standard Special Provision, the manufacturer's recommendations, and procedures for the cutting and installation. The contractor must also supply the IIC with the manufacturer's instructions for the installation of the materials, application temperatures, proper mixing techniques, and any other information necessary to correctly complete the application.

After markings are laid out, they are approved by the Department prior to placement.

Clean the roadway surface where the wet-reflective pavement markings will be applied. Recess the pavement markings into the final pavement surface. This includes newly paved asphalt after the final rolling of the surface, concrete pavement, concrete bridge decks, and interchange ramps. Diamond cut the recessed area to a depth of 90 to 110 mils and 1 inch wider than the width of the pavement marking. Clean the grooved pavement surface to remove dirt and residues. Marking operations shall not begin until applicable surface preparation work is completed and approved by the Representative.

For tape marking applications, the surface must be dry pavement when no rainfall has occurred for 24 hours prior to the application, the surface temperature is 70F and rising, and the air temperature is 40F and rising unless otherwise approved by the Representative and the manufacturer. After the tape is applied in the groove, slowly drive over the tape to tamp with a vehicle and procedure as recommended by the manufacturer.

For polyurea marking applications, the marking must be installed on dry pavement only if the road surface and ambient temperatures are 32F or higher unless otherwise approved by the Representative and acceptable to the manufacturer. Follow the procedures for Option A: Triple Drop or Option B: Double Drop requirements for retroreflective optics chosen by the contractor.

Test both dry and wet retro reflectivity before the end of the 90-day observation period but at least 30 days after the pavement markings are installed in the direction of traffic.

Test the adhesion of the wet-reflective pavement markings before the end of the observation period but at least 30 days after the pavement markings are installed in the direction of traffic.

For tape-applied markings, a written five-year warranty is to be provided.

Measuring & Payment Methods

Preformed wet-reflective striping tape (tape) markings and polyurea resin (hot-sprayed) pavement markings are paid by the linear foot and are field-measured and paid on a PSA.

REFERENCES

Approved Concrete Mix Designs and Source of Supply – [ECMS](#)

Approved Maintenance and Protection of Traffic Plan – MCDocs

Approved Quality Control Plan – [PPCC](#)

Approved Pavement Marking Plan – MCDocs

[CS-4225A](#) Ground Rod Test Form

[CS-4225B](#) Conductor Insulation Resistance Test Form

[CS-4225C](#) Circuit Performance Test Form

[CS-4225D](#) Highway Illumination Test Form

[CS-4225E](#) Sign Illumination Test Form

[CS-4225G](#) Conventional Lighting Poles Static Load Test Form

[Manual on Uniform Traffic Control Devices \(MUTCD\)](#) for Streets and Highways

[PUB 2](#) Project Office Manual

- Part B, Section 6 Materials on Control Projects
- Part C, Section 9 Traffic Accommodation and Control (900)

[PUB 35](#) Qualified Products List for Construction (Bulletin 15)

- Section 901 (Maintenance and Protection of Traffic During Construction)

[PUB 46](#) Traffic Engineering Manual

[PUB 72M](#) Roadway Construction Standards

- RC Standard 57M (Concrete Median Barrier)
- RC Standard 58M (Single Face Concrete Barrier)
- RC Standard 59M (Single Face Concrete Barrier Survey Transitions)
- RC Standard 80M (Highway Lighting-Conventional Lighting)
- RC Standard 81M (Highway Lighting-Junction Boxes-Light Duty)
- RC Standard 82M (Highway Lighting-Junction Boxes-Heavy Duty)
- RC Standard 83M (Highway Lighting-High Mast Lighting)
- RC Standard 84M (Highway Lighting-Lighting and Electrical Details)

[PUB 111](#) Traffic Control-Pavement Markings and Signing Standards

- TC Standard 8600 (Pavement Markings – Expressway/Freeway)
- TC Standard 8702A (Post-Mounted Signs, Type A)
- TC Standard 8702B (Post-Mounted Signs, Type B)
- TC Standard 8702C (Post-Mounted Signs, Type C)
- TC Standard 8702D (Post-Mounted Signs, Type D)
- TC Standard 8702E (Post-Mounted Signs, Type E)
- TC Standard 8715 (Sign Lighting)

[PUB 148](#) Traffic Standards-Signals

- TC Standard 8800

[PUB 212](#) Official Traffic Control Devices

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[PUB 213](#) Temporary Traffic Control Guidelines

- Appendix C (TTC Device Quality Guidelines)

[PUB 236](#) Handbook of Approved Signs

[PUB 408](#) Highway Construction Specifications

- Section 704 (Cement Concrete)
- Section 709 (Reinforcement Steel)
- Section 901 (Maintenance and Protection of Traffic During Construction)
- Section 910 (Highway Lighting)
- Section 920 (Sign Lighting)
- Section 930 (Post Mounted Signs, Type A)
- Section 931 (Post Mounted Signs, Type B)
- Section 932 (Post Mounted Signs, Type C)
- Section 933 (Post Mounted Signs, Type D)
- Section 934 (Post Mounted Signs, Type E)
- Section 935 (Post Mounted Signs, Type F)
- Section 936 (Structure Mounted Signs)
- Section 950 (Traffic Signals – General)
- Section 951 (Traffic Signal Supports)
- Section 952 (Controller Assembly)
- Section 953 (Traffic Signal Systems and Communications)
- Section 954 (Electrical Distribution)
- Section 955 (Signal Heads)
- Section 956 (Detectors)
- Section 957 (Advanced Traffic Signal Technology)
- Section 960 (Hot Thermoplastic Pavement Markings)
- Section 962 (Waterborne Pavement Markings)
- Section 963 (Pavement Marking Removal)
- Section 964 (Epoxy Pavement Markings)
- Section 965 (Preformed Thermoplastic Pavement Markings)
- Section 1101 (Highway Lighting)
- Section 1102 (Sign Lighting)
- Section 1103 (Traffic Signing and Marking)
- Section 1105 (Fabricated Structural Steel and Aluminum)

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SECTION 1000: STRUCTURES

GOALS

- Ensure that structures are constructed in accordance with the specific designs, provisions, and specifications required by the contract's special provisions, to achieve a 100-year bridge life.
- Ensure that all rehabilitated structures include all the required repairs in accordance with the specific designs, provisions, and specifications required by the contract's special provisions.

STRUCTURE SAFETY

- **Traffic Control:** Properly set up in accordance with drawings and PUB 213.
- **Traffic Flow:** Be aware of the direction of travel and how equipment and delivery trucks are entering and exiting the work area.
- **Moving Equipment:** Structure operations have many pieces of equipment in the work zone. Constantly be aware of what all pieces of equipment are doing and maintain eye contact with the operator when moving in or near the equipment.
- **Backup Alarms:** Monitor equipment for working backup alarms. Inform the supervisor immediately if a piece of equipment or delivery truck backup alarm is not working.
- **Fall Protection:** Review training on using fall protection equipment and when it is required.
- **Personal Protective Equipment (PPE):** Wear proper PPE when working near construction operations, including but not limited to, hearing protection, safety glasses, goggles, and face shields.
- **Crane Safety Awareness:** Ensure you and others are standing clear of the crane when objects are being lifted and positioned.
- **Drill Rig Safety Awareness:** Ensure you and others are clear of the drill rig as drilling operations occur, including raising and lowering the drill tools. Do not stand in the excavation during drilling.
- **Rebar Cage Placement:** Stand sufficiently clear of rebar placement operation in case of collapse. Be aware that the rebar cage is unstable during lifting and placement. The contractor must provide temporary lifting devices and use extreme care.
- **Excavation Protection Ring:** Ensure that sufficient protection measures are placed to ensure physical entry into the caisson hole is prohibited.

1. REMOVAL OF EXISTING BRIDGES OR CULVERTS (SEC. 1018)

This section addresses the removal of existing structures or structural elements in accordance with PUB 408 Section 1018.

☐ Review  Documentation Required

BEFORE REMOVAL OF EXISTING BRIDGES OR CULVERTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Confirm all outside agencies have been notified of the demolition and its schedule and that agencies have given their approval for the plan, and a copy of the approved plan is in the project files.	MCDocs
☐	Ensure all safety devices (e.g., fences, nets, and warning signs) are in place as required.	
☐ 	Verify a PennDOT-approved copy of the demolition plan is on site.	MCDocs

DURING REMOVAL OF EXISTING BRIDGES OR CULVERTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify debris removed from the site is disposed of in the designated location (e.g., waste areas, fill areas, or off-site location).	
☐	Ensure the contractor is strictly following the approved demolition plan. Inform the Inspector-in-Charge (IIC) if the plan is not being followed, including the use of equipment not in the plan.	MCDocs

AFTER REMOVAL OF EXISTING BRIDGES OR CULVERTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

There is no material list for this operation.

The equipment used is specified in the approved demolition plans. Verification can be made with the submitted catalog cuts for the equipment.

Construction Methods

All work must be completed in strict accordance with the approved demolition plans.

Measuring & Payment Methods

Payment is typically made as a lump sum item. Progress payments can be made on a schedule agreed to by the contractor and inspection staff.

2. STRUCTURAL BACKFILL (SEC. 205)

This section addresses the placement of structural backfill. Refer to Section 206 of this PUB for additional information regarding compaction requirements.

☐ Review  Documentation Required

BEFORE STRUCTURAL BACKFILL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure geotextile material is used to separate structural backfill material from adjoining material, such as embankment, excavated earth, and roadway subbase.	
☐	Verify all drains, waterproofing, and other embedded materials are placed prior to backfilling.	MCDocs
☐ 	Confirm compaction equipment can obtain the required compaction per PUB 408 Section 206.	

DURING STRUCTURAL BACKFILL CONSTRUCTION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure abutments, back walls, retaining walls, box culverts, or arches are not backfilled until seven days after the concrete placement, and only if compressive strength is achieved per PUB 408 Section 1001.3.	
☐ 	Collect truck delivery tickets for materials.	eTicketing
☐ 	Ensure materials for weep holes are placed per structure plans and concurrent with backfilling operations.	MCDocs
☐	Verify that excavations performed outside the required limits are replaced with structural backfill and considered incidental to the excavation.	
☐ 	Perform and record compaction reports.	

☐		Task	Reference
☐		Confirm the structural backfill is placed simultaneously with adjoining embankments per PUB 72M RC Standard 12M.	
☐		Ensure symmetric loadings of backfill are maintained when placed adjacent to box culverts, arch rings, and other rigid frame structures.	
☐		When backfilling integral abutments, ensure both abutments are backfilled simultaneously within specified elevation tolerances per PUB 72M RC Standard 12M.	
☐		Verify that backfill is placed and compacted in lifts as required by the specifications. Ensure compaction reports are completed for each lift of backfill per PUB 408 Section 206.	
☐		Confirm the material near the rear face of abutments and wings is compacted with a walk-behind vibratory plate in (4-inch) lifts, as required by the specifications and PUB 408 Section 206.	

AFTER STRUCTURAL BACKFILL CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

The aggregate used for backfill is one of the types listed in PUB 408 Section 205. The backfill types are also listed on PUB 72M RC Standard 12M; Plan documents sometimes specify the type of aggregate to be used. If the plan documents do not specify the type of aggregate, the contractor chooses one from PUB 408 Section 205 or PUB 72M RC Standard 12M.

Equipment used for structural backfill includes excavators, rollers, gradalls, bulldozers, front end loaders, vibratory plates, and other earth-moving, excavating, and compaction equipment. The equipment used must have the capacity to meet the requirements for placement and compaction set by the plans and specifications.

Mechanical:				
Bulldozer	Excavator	Front End Loader	Gradall	Vibratory Plate Compactor
Vibratory Steel Wheel Roller				

Construction Methods

After excavation and structure placement are complete, the contractor places geotextile and waterproofing/drainage as needed in the area to be backfilled. Backfill material is placed using lifts; each lift is then compacted. Backfill material is placed simultaneously against each abutment, and differences in backfill height are limited according to notes on the plan or PUB 72M RC Standard 12M. Material for weep holes, such as geotextile and No. 57 aggregate, is placed as required.

Backfill continues until the desired elevation is achieved. If applicable, the backfill is covered with a layer of geotextile to separate the backfill material from adjoining or layered fills (e.g., roadway subbase).

Measuring & Payment Methods

Structural backfill is measured and paid as part of the lump sum bridge item, in cubic yards, or by the ton.

Geotextile material is considered incidental to structural backfill.

3. TEMPORARY EXCAVATION SUPPORT SYSTEM

This section addresses temporary excavation support and protection systems (also referred to as shoring). There are a variety of methods and materials used to build temporary excavation support systems; therefore, the discussion in this section is generalized.

It is required that temporary excavation support systems be designed by a Professional Engineer (PE) registered in the Commonwealth of Pennsylvania and hired by the contractor.

☐ Review  Documentation Required

BEFORE TEMPORARY EXCAVATION SUPPORT SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review Pile Driving and Pile Driving Log Form CS-1005 Training Videos.	Construction Training Videos
☐ 	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC
☐	Confirm all work is completed in strict compliance with the approved design due to numerous safety issues associated with large excavations.	OSHA 1926.650, 651, & 652 Subpart P
☐	Verify fences, barriers, or other approved methods are used to protect people from falling into open excavations.	
☐	Ensure restrictions on excavation depth permitted are understood prior to placing the initial or additional excavation support system. Support systems are often placed concurrently with excavation.	

DURING TEMPORARY EXCAVATION SUPPORT SYSTEM CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Record sketches, testing, and other required information in the Field Survey Book (FSB).	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete quality control (QC) plan, so test results are within specified limits.	eConcrete MCDocs
☐		Ensure that a stairway, ladder, ramp, or other safe means of egress from the excavation are located per OSHA standards.	OSHA 1926.651(c)(2) 1
☐		Confirm materials are inspected for damage and compliance with the design prior to their use.	
☐		Ensure soldier piles are installed to the required design depth and spacing, allowing safe and proper wall construction.	
☐		Verify that pre-drilled soldier piles are placed in sockets and backfilled with proper material (concrete, aggregate, etc.) in accordance with the approved design.	PPCC
☐		Confirm that post-tensioning of anchors is performed as required by the approved design.	PPCC
☐		Ensure pull (verification and proof) tests are performed on anchors, soil nails, and other components as required by the approved design.	PPCC
☐		Verify testing of grout is performed and documented as required.	PPCC
☐		Confirm proper approved measures are taken to adequately dewater excavations.	PPCC
☐		If movement or cracking occurs during installation and excavation, notify the IIC for review.	PPCC

AFTER TEMPORARY EXCAVATION SUPPORT SYSTEM CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		When the shoring is completely installed, pay 100% of the lump sum. If the shoring system is large and is constructed over multiple	

☐		Task	Reference
		estimate periods, it may be warranted to pay a percentage of the lump sum.	
☐		Ensure the PE certification of proper installation is received within three days of completion.	
☐		Verify excavation support systems are removed as required by the special provisions and/or shop drawings. It may be permissible to cut off the piles instead of removing them completely. If this is proposed, the piles must be removed at least three feet below the final grade.	
☐		Monitor the system for signs of movement, especially after rain events. Cracking or settlement of the soil behind the support system is generally an indication of movement. Notify the IIC of any movement.	
☐		After removal, reuse of material from excavation support systems is only permitted, as noted in the approved design.	

Material & Equipment

Construction materials include steel rebar, tieback anchors, piles, sheet piling, and studs. Wood may be used for lagging and bracing. Construction of some support systems may also require concrete and related materials, such as grout, mortar, and shotcrete. Tensioning for anchors may require the use of hydraulic jacks.

If used steel is proposed, it must be in serviceable condition.

Equipment used for excavation includes drill rigs, excavators, loaders, augers, and trenchers.

Pumps and other devices may be used for dewatering.

Mechanical:				
Auger	Crane	Drill Rig	Excavator	Front End Loader
Hydraulic Jack	Trencher	Vibratory Hammer	Water Pump	

Construction Methods

Excavation support systems may incorporate sheet piles, soldier pile and lagging, soil nails, micro/mini piles, pressure grouting, slurry walls, tieback anchors, Deadman anchors, geosynthetic reinforced slopes, concrete jumbo blocks and underpinning or other approved methods.

Sheet piles are a series of interlocking steel shell piles driven into the earth with a vibratory hammer to the specified depth of the approved drawings. This allows excavation to be performed adjacent to the sheets. Sheet piles are often the method used for excavations near buildings,

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structures, and cofferdams. They provide a neat vertical face with minimal disturbance to surrounding areas. Sheet piles cannot penetrate bedrock.

In the soldier pile and lagging method, piles are placed into a pre-drilled hole and backfilled or driven into the ground using a pile hammer to the required depths. Excavation is performed adjacent to the piles by placing wood lagging behind the flanges of the piles or by attaching the lagging to the outside of the flanges with welded studs concurrent to excavation. This is the most common method used for large excavations. If the design of the embedded portion of the pile shows it is encased in concrete, the inspector should confirm and document this when the piles are placed.

The soil nail system incorporates a series of closely placed steel tendons (nails) placed into the face of an excavation and given a shotcrete face. This method of support is good for sandy soils and small working areas.

The pressure grouting method uses pressure to inject grout into voids, cracks, and cavities to stabilize the ground for adjacent excavation or other construction activities.

Slurry walls use a slurry material (bentonite) to stabilize excavation walls, while excavation equipment removes the material beneath the slurry. Slurry remains in the excavation until fill concrete is poured. The concrete displaces the slurry from the excavation. This method is typically used when room for other excavation support systems is limited.

Tieback anchors are often used in conjunction with other excavation support systems, such as soldier pile walls and sheet piling, to provide extra lateral support. Tiebacks comprise shafts with casing drilled deep into the earth, creating a rock socket. Tension steel and pumped grout is placed in the casing. The casing is removed, and the steel is post-tensioned and locked into place. After the grout hardens as required, a pull test on the anchor is performed.

Deadman anchors are a type of excavation support system that offers lateral support to other excavation support systems. They are similar to tieback anchors in this regard, but instead of using tension, they rely on a heavy weight and/or friction to resist lateral earth forces. Typically, this involves burying a large block of concrete or a piece of steel in the ground. Deadman anchors are used when shoring is placed at the same time as an adjacent embankment.

Underpinning is used to stabilize existing structures that have foundations directly adjacent to the excavation. Underpinning extends the support system of a structure to a deeper, more stable soil stratum.

Before installing the temporary shoring system, the contractor must submit the design to the District Geotechnical Engineer (DGE), Structure Control Engineer (SCE), or Design Consultant for review and approval. Soil and rock parameters listed in the contract special provision must be used to analyze the shoring system, and it must be designed in accordance with contract special provisions, PUB 15M, and the AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications. The inspector must pay attention to the construction of the shoring system. Pile spacing and embedment depths must follow the design. During installation, watch for cracks in the ground surface or unstable earth. The contractor should not leave vertical or steep excavations open without shoring in place. If any portion of the shoring system is unable to be advanced to the depth specified in the design, inform the IIC, who will notify the DGE and/or District SCE.

If the contractor proposes a layback, it must be reviewed and approved to ensure that it is within the right-of-way (ROW), can be excavated safely, and remains stable during construction activities.

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While the temporary excavation support system is in service, periodically monitor the system for signs of movement, especially after rain events. Cracking or settlement of the soil behind the support system is generally an indication of movement. Inform the IIC of any concerns, who will notify the DGE and/or District SCE.

Measuring & Payment Methods

Temporary excavation support system construction is paid as a lump sum item.

If an acceptable open-cut excavation is provided instead of the temporary excavation support system, payment will be made for the as-bid lump sum item. No additional payment will be made for any class of excavation, backfill, or additional shoring as a result of the open cut or to restore the ground to its original condition.

4. PILES (SEC. 1005)

This section addresses the installation of piles, including test piles and production piles. Pile types include steel H-piles and cast-in-place (CIP) concrete piles using steel shells.

Steel-H Pile

Steel-H pile is the most common type of pile and varies in section length.

Cast-in-Place (CIP)

CIP concrete piles are watertight steel shells that are driven and then filled with concrete and rebar.

Test Piles

Test piles are used to verify that hammer performance and pile penetration are as expected. Test piles may also have dynamic and/or static pile load tests performed to verify the capacity and integrity of the installed piles.

Production Piles

Production piles are driven to provide structural support for structural foundations.

☐ Review  Documentation Required

BEFORE PILES CHECKLIST

☐  Task	Reference
☐  Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐  Ensure the contractor performing the pile driving submits the data for the proposed pile driving equipment to be used, as well as the type, size, and length of piles to be driven, to the SCE on Form CS-5 for review. Allow a minimum of two weeks for review.	PPCC
☐  Obtain a pile hammer approval letter containing the minimum and maximum stroke lengths for the hammer submitted from the Central Office Bridge Unit.	PPCC
☐  Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC
☐  If splicing of the piles is anticipated or if pile tip reinforcement will be installed by the contractor, the contractor submits a Weld Procedure Specification (WPS) on Form TR-50 (for CIP concrete piles with steel shells) or TR-52 (for steel H-piles) to the District SCE. Verify approved procedures before driving operations.	PPCC

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☐		Task	Reference
☐		When the pile hammer arrives at the project, confirm that the make and model match the hammer approval letter. Different manufacturers may use the same model numbers, but hammers from different manufacturers are not interchangeable without prior approval. If the pile hammer helmet contains a replaceable cushion, verify that the cushion materials are not damaged or excessively worn. This requires partial disassembly of the hammer and is performed when the hammer arrives on site or the day before driving the piles.	PPCC
☐		Confirm that the pile hammer driving head is appropriate for the type and size of the piles being driven and capable of holding the top of the pile in the correct position while distributing the force of the blows over the entire area.	
☐		Review the structure core borings for changes in subsurface strata that may affect the penetration of the pile.	
☐		Ensure excavation is complete to the bottom of the footing elevation indicated prior to pile driving unless permitted by the District SCE or DGE.	MCDocs
☐		Verify embankment material is placed at the bottom of the footing elevation indicated and that any required quarantine period for the embankment has elapsed.	
☐		Confirm piles are marked in foot and inch increments as required so the inspector can determine refusal and payment length. Inch markings are only required near the top end of the pile for the last several feet of driving.	
☐		Ensure piles are oriented, battered, and located per the plans prior to driving.	MCDocs
☐		Verify the required distance is maintained from uncured concrete to the pile driving operation, as noted in PUB 408 Section 1005.	

DURING PILES CHECKLIST

☐		Task	Reference
Steel Piles			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Document on Form CS-1005 Pile Driving Log all the necessary information (e.g., pile length and size, splice length, depth of penetration, blow counts) about the pile prior to, during, and after driving.	
☐		Ensure that all splices and pile tips comply with PUB 219M BC Standard 757M.	
☐		Confirm welding for pile splices and pile tips is satisfactory. Appendix A: Field Welding.	
☐		Confirm the correct hammer and pile variables for accurate meter operation are loaded when using a saximeter (a device that counts hammer blows automatically).	
☐		Ensure that all piles are driven to absolute refusal or end-of-driving criteria as determined by the District SCE based on the results of the test piles. Refer to the minimum driving requirements for refusal in PUB 408 Section 1005.	
☐		Verify that the same hammer, using the same procedures, is used to drive bearing piles as to drive test piles.	
☐		Confirm piles raised by the driving of adjacent piles are re-driven to refusal.	
Cast-in-Place (CIP) Concrete Piles			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan, so test results are within specified limits.	eConcrete MCDocs
☐		Verify hammer stroke and blow count are closely monitored during the entire pile driving operation to verify that the desired pile bearing resistance is achieved without over-driving or damaging the pile.	
☐		Ensure driven steel shells are inspected using a light on a cord long enough to reach the bottom of the shell.	
☐		Verify the open tops of steel shells are covered to prevent water entry.	
☐		Confirm reinforcement on top of the concrete pile is placed as indicated on the structure plans.	MCDocs

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☐		Task	Reference
☐		Ensure no water or debris has entered the steel shells prior to concrete placement. Water in a driven steel shell may be an indication of damage during driving; notify the District SCE if any water is present in the steel shells after driving.	
☐		Verify placing, curing, and documenting the concrete placed in the steel shells are completed as required.	eConcrete

AFTER PILES CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure that the piles have been installed according to the structure plans and are within the tolerances noted in PUB 408 Section 1005.	
☐		Verify that the District SCE approves piles that attain absolute refusal prior to reaching predetermined elevations.	
☐		Confirm that after driving and any required restrrike, piles are cut to the elevation(s) indicated in the structure plans.	MCDocs
☐		Complete Form CS-1005 to document a detailed record of each pile's placement and payment calculations and reference it in the Project Site Activity (PSA).	

Material & Equipment

Materials used for CIP concrete piles includes steel shell casing pipe and class A cement concrete and reinforcing. Materials used for steel piles include the steel H-Piles and a cast tip reinforcement.

Equipment typically used for installing piles includes cranes, pile hammers (typically single-acting diesel hammers), pile hammer leads that guide the hammer and pile during driving, levels, welders, air compressors, and torches.

Testing equipment such as a saximeter (a handheld device that calculates the stroke length and energy of the hammer) or dynamic pile load testing equipment (a computer with sensors attached to the pile that calculates stresses in the pile as well as pile capacity and integrity) may also be specified.

Mechanical:				
Air Compressor	Crane	Pile Hammer	Pile Hammer Leads	

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Hand Tools:				
Field Welding Equipment	Torch			
Testing/Inspection:				
Dynamic Load Tester	Pile Driving Analyzer	Saximeter	Smart Level	

Construction Methods

Before the start of driving, the contractor submits documentation detailing the types, sizes, and capabilities of the pile driving equipment, as well as the type, size, and length of the piles to be driven, to the District SCE on Form CS-5. This form is forwarded to the Bridge Unit for approval before driving. The Bridge Unit will provide a pile hammer approval letter specifying the minimum and maximum stroke length of the hammer based on the specifics of the project.

Piles may be installed either in excavated areas or through built-up embankments. After the area of the footing reaches the indicated elevation (or some other elevation agreed to by the Department), the contractor lays out the pile pattern as indicated. Pile tip reinforcement is welded by a certified welder or otherwise attached to the driving end of the pile before placement into the hammer leads.

Test piles are driven at the indicated locations and orientations. The District SCE witnesses the test pile driving operation to determine if any changes in driving requirements are necessary before production piles are driven. The remaining piles are then driven based on the pile hammer approval letter and termination criteria established from the test piles.

When necessary, pile splicing is performed according to a WPS submitted on Form TR-50 or TR-52 and accepted by the District SCE, as well as the approved splice details as shown in the Bridge Construction Standards. Welding may be needed to splice H-piles and steel shells for concrete piles. The contractor must have a welding procedure approved by the SCE before any welding. It is important to monitor the location of the splices. PUB 408 Section 1005.3 gives the requirements, which depend on the total number of piles in the substructure. At the butt ends, extensions at least 5 feet long must be used for 75 percent of the piles in a substructure unit. At the tip ends, extensions must be at least 5 feet in all instances. After splicing, driving may resume when the temperature of the steel in the splice reaches the ambient air temperature.

After piles meet the required embedment length and Absolute Refusal or End of Driving Criteria, as determined by the SCE, review the location and orientation of the piles as installed compared to the tolerances listed in PUB 408 Section 1005.3. If a mandatory restrrike period is specified or directed, the contractor will use the same driving equipment used for initial driving to restrrike the indicated piles. After the tolerances of the piles have been verified and any restrrike has been completed, the piles are cut at the indicated elevation(s).

If CIP piles are used, the contractor's PennDOT-certified concrete technician tests the concrete for air, slump, and temperature in accordance with PUB 408 Section 704 and the approved concrete QC plan.

In some cases, pre-drilling is required for pile driving operations. Refer to PUB 408 Section 1005 for pre-drilling requirements.

Measuring & Payment Methods

Test piles are paid per item, including pile tip reinforcement, for the estimated length of the pile(s) as indicated. Test pile lengths in excess of the estimated length are paid at the contract unit price for production piles.

Production piles are paid by the linear foot. Production pile tip reinforcements are paid each.

Pre-drilling is paid by linear foot.

The material used for the piles can be paid for as stored material.

5. DRILLED CAISSONS (SEC. 1006)

This section addresses reinforced cement concrete drilled caisson foundations formed within drilled excavations in accordance with PUB 408 Section 1006.

☐ Review  Documentation Required

BEFORE DRILLED CAISSONS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review Approved Drilled Caisson Installation Plan.	MCDocs PPCC
☐ 	Review the Structure Foundation Report, if available.	MCDocs
☐	Review Caisson Placement Presentation.	Caisson Presentation
☐ 	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC

DURING DRILLED CAISSONS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the depth, location, and orientation of the caissons during excavation are as specified in the plans and within the tolerance parameters as noted in PUB 408 Section 1006. Note soil shaft excavation vs. rock socket excavation.	

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☐		Task	Reference
☐		Check the stability of the drilled shaft sidewalls. If unstable material or groundwater is encountered, shaft casings may be required. Permanent shaft casings may or may not be required.	
☐		Ensure that dewatering has been performed with approved methods prior to excavation inspection and concrete placement if indicated in the plan. Many caissons are placed with water in the hole, which requires tremie placement. Excavated shafts are inspected using a Submersible Inspection Device (SID) and a downhole camera and approved prior to concrete placement. Shafts are covered to prevent entry or accidents.	
☐		Verify that rebar is placed in the drilled caisson shafts per plans and specifications, maintaining proper projections, spacing, and clearances. Approved spacing devices are used to maintain the rebar's position. Proper lifting techniques are used to prohibit the racking or shifting of the bars.	
☐		Confirm rebar position and excavation cross section are maintained during casing removal and/or concrete placement.	
☐		Verify the Thermal Image Profiling (TIP) materials and, if required, ensure the Crosshole Sonic Logging (CSL) access tubes are installed at each caisson per PUB 408 Section 1006.	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan, so test results are within specified limits.	eConcrete MCDocs
☐		Document the SID testing, showing three sediment depth measurements at each of the five shaft locations, and note the time of approval per PUB 408 Section 1006.	
☐		Ensure that no excavation within a distance equal to three diameters of the concrete-filled caissons is performed within 24 hours of concrete placement per PUB 408 Section 1006.	
☐		Verify that load testing is performed if required by contract documents.	
☐		Confirm that water pumped or overflowed from the caisson is routed to a filter bag.	

AFTER DRILLED CAISSONS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify a detailed inspection report, including any required TIP and CSL test results, is submitted for each shaft per the requirements of PUB 408 Section 1006.	PPCC
☐ 	Payment calculations or references to payment calculations as needed for each payable caisson element. Caissons are not paid until testing is complete and the results are reviewed and found to be acceptable.	ECMS

Material & Equipment

The concrete used in the caissons must be supplied from an approved concrete plant and mixed using an approved concrete mix design for the class of concrete indicated. Self-Consolidating Concrete (SCC) is commonly used for caissons due to its ability to flow readily through the tremie and around the rebar to fill the shaft.

In excavating, a contractor uses a drill rig capable of drilling/auguring a hole larger than 30 inches in diameter. Under-reamers, special rock augers, core barrels, and air drilling rigs are used for excavating caissons. Casings may be required if caving or groundwater is a problem.

Pumps or similar devices may be required for dewatering the excavation. If dewatering cannot be accomplished, an underwater camera may be used for excavation inspections. If dewatering is not a problem, an electric light is used to inspect the caisson excavation.

TIP is used to measure the temperature profile within the deep foundation to evaluate concrete consolidation. Materials for this system include thermal wires, wire splices, data loggers, and connection/charging wires.

CSL is another testing system used to monitor the integrity of the concrete in the caisson. Schedule 40 steel pipe access tubes are used, along with spacers, shoes, and caps.

Mechanical:				
Air Drilling Rig	Auger	Caisson Cleaning Bucket	Concrete Pump Truck	Core Barrel
Crane	Drill Rig	Filter Bag	Tremie	Under-reamer
Water Pump				
Testing/Inspection:				
Crosshole Sonic Logging	Downhole Camera	Submersible Inspection Device (SID)	Thermal Image Profiling (TIP) Wires	

Construction Methods

Prior to any caisson operations, the contractor must submit a Drilled Caisson Installation Plan for approval by the SCE or DGE. The qualifications of the contractor and key personnel proposed for the caisson operations must also be submitted. A Drilled Caisson Pre-Construction Meeting must be held a minimum of seven days prior to the operation. Key personnel from the contractor's team who will be onsite during the caisson placement must participate in the meeting.

The contractor uses earth augers, under-reaming tools, rock augers, core barrels, or air tools to excavate holes to the correct size and depth. If required, the contractor will bell (enlarge) the bottom of the excavation. If caving, groundwater, or unstable rock is encountered during excavation, the contractor may use casing to support excavation walls.

The construction sequence is important and must be planned. Caisson excavation cannot be done within three diameters of new caissons until at least 24 hours after the concrete placement. Rock socket excavations cannot be exposed to water for more than 48 hours. If that time passes, the rock sockets must be reamed with a grooving tool to remove any deteriorated material that is the result of the exposure.

After excavating, the shaft must be inspected and accepted. A cleanliness inspection, using a SID, will be performed at the bottom of the shaft at five locations. Fifty percent of the base of each socket will have less than ½ inch of sediment, and no part of the base can have sediment exceeding 1½ inches. If the sediment in the hole does not meet the specifications, the hole must be cleaned out and another inspection performed. Concrete must be placed within three hours of the approved SID inspection.

The inspector must observe the contractor lifting the rebar cage for placement into the shaft. The contractor should use proper lifting techniques according to the pre-caisson plan, and each cage should be lowered into the hole in a manner that will prevent distortion or racking. Spacers and boots will be placed on the cage to ensure proper spacing from the sides and bottom. Ensure the TIP wires are not damaged during this placement.

Prior to concrete placement, the contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan.

Concrete is placed using freefall, tremie, or pumping methods, and the contractor may or may not remove the casing during concrete placement.

The Tremie method is used with SCC. Prior to the placement of concrete, check the tremie tube to make sure it is airtight. During the entire tremie placement, the discharge end of the tube must stay immersed at least five feet in the concrete.

Overflow the concrete until only fresh, uncontaminated concrete is visible at the surface. The contractor must remove concrete laitance, which is the milky or powdery layer of cement dust, lime, and sand fines mixed with water that will rise to the top of the shaft. All overflow concrete must be completely removed. Water from the overflow of the shaft should be directed to a filter bag. It should not be allowed to run directly into the stream.

TIP is the primary test method to verify that the concrete in the shafts is acceptable. The TIP results must be submitted to the SCE or DGE for review. If the data is not valid or the integrity of the caisson is in question, CSL testing will be used as the secondary (backup) test method. If the testing does not show acceptable results, the caissons will be evaluated by core drilling. The core drilling items are only paid if the quality of the caisson is determined to be acceptable. If the cores show poor-quality concrete, the drilling is at the contractor's expense. The contractor must submit a corrective action plan for review and approval by the SCE or DGE.

Measuring & Payment Methods

Shaft sections, rock sockets, casing, test holes, and probe holes are measured and paid in linear feet.

Temporary casing not removed will be paid as permanent casing.

Bell footings are paid per item.

Caissons are not paid until testing is complete and the results are reviewed and acceptable.

6. MECHANICALLY STABILIZED EARTH WALLS

This section addresses the construction and inspection of mechanically stabilized earth (MSE) walls. MSE walls are retaining walls constructed on subgrade using a leveling pad, concrete face panels, soil stabilizing straps, and aggregate backfill. Top-of-wall coping, moment slabs, and barriers are utilized on top of the wall for safety. They are used in areas where retaining the natural slope is not practical due to ROW or physical space constraints.

☐ Review

 Documentation Required

BEFORE MSE WALLS CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Verify materials and requirements for the wall have been reviewed and approved prior to construction.	PPCC

DURING MSE WALLS CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Accept the compaction either through the use of nuclear density or by visual non-movement under compaction equipment. Document compaction on Forms TR-4276B or TR-478A and attach to PSA.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan, so test results are within specified limits.	eConcrete MCDocs
☐		If required by the contract's special provisions, verify that a Representative from the wall fabricator or designer is on-site at the beginning of construction to assist and advise on construction methods.	
Subgrade			

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure excavation or fill operations are performed with the materials specified and to the required dimension set by the plans and shop drawings.	
☐		Verify that the subgrade is brought to the required elevation and density prior to wall construction.	
☐		Ensure that the District SCE or DGE approves the subgrade/foundation beneath the aggregate.	
☐		Confirm that drainage, as required by the plans and shop drawings, is constructed before backfilling operations begin.	
Leveling Pad			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor surveys the leveling pad to ensure its proper location in accordance with the plans and shop drawings. Correct placement is critical as the wall positioning depends on the leveling pad.	
☐		Verify the formwork for the leveling pad is thoroughly checked to ensure the minimum required dimensions and level.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan, so test results are within specified limits.	eConcrete MCDocs
Concrete Face Panels			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Upon their arrival at the construction site, inspect panels for damage and confirm as the correct item. All panels must have identification markings from the fabricator verifying specifications such as correct designation, dimensions, and strap construction.	
☐		Confirm panels have a plant inspector's stamp verifying that the panels were manufactured per plans and shop drawings. Panels without stamps are not permitted in wall construction.	
☐		Verify the contractor positions the bottom row of panels according to the plans and shop drawings. Special care is taken in the	

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☐		Task	Reference
		placement of each panel, as incorrect placement may have irreversible consequences.	
☐		Check the tops and sides of each panel for level and plumb and inform the contractor if they need to be corrected.	
☐		Ensure panels are battered front and back in a manner that allows for movement (forward push) during backfill. When backfilling is complete, all panel faces are checked for plumb or very near plumb within the required tolerances. The intentionally placed batter is eliminated due to the forward push of the backfill compaction equipment.	
☐		Verify that previously placed panels are checked regularly to ensure expected performance and integrity.	
☐		Ensure damaged panels are discarded or repaired using approved repair procedures.	PPCC
☐		Verify all panel joints are covered with geotextile.	
Backfill/Stabilizing Straps			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify approved material and placement methods are used for backfill, as required by the plans and shop drawings and the MSE wall Designer Representative.	PPCC
☐		Confirm aggregate used for the backfill has been tested and approved by the materials technician.	eCAMMS
☐		Pay close attention to backfill compaction and lifts in providing proper interaction between backfill and stabilizing straps.	
☐		Ensure backfill is completed by a specified roller and is not compacted too forcefully or too close to the face panels, which may result in pushing panels out of plumb.	
☐		Verify compaction near the wall is performed by a vibratory plate or other small compaction equipment, providing adequate compaction and desired panel movement.	
☐		Confirm backfilling of MSE material and embankment fill is completed concurrently and with the elevation of the materials within the required limits.	

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☐		Task	Reference
☐		Ensure stabilization straps are free of damage and of the correct size.	
☐		Verify equipment is not driven directly on the straps until the backfill is placed on the straps.	
☐		Confirm the connection between the straps and the panels is performed properly.	
Moment Slabs/Barrier/Coping			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the correct concrete is used and that testing procedures are performed as required for each element according to the plans, shop drawings, and specifications.	PPCC
☐		Inspect pre-cast elements for damage and plant inspection tags upon delivery.	
☐		Ensure rebar is placed per plans and shop drawings.	ECMS
☐		Confirm panels are checked periodically for unwanted movement during forming, concrete placement, and pre-cast placement.	
Drainage			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure weep holes are in the proper locations and surrounded by geotextile and No. 57 aggregate as required.	
☐		Verify the impervious membrane is placed so that overlaps and slopes allow all water to flow freely to the drainpipe. The slope must be in accordance with plans and shop drawings.	
☐		Confirm backfill is placed on the impervious membrane prior to permitting construction traffic to prevent damage to the membrane.	
☐		Ensure the drainage pipe is placed on the impervious membrane at the correct slope so that drainage to the desired outlet is achieved.	
☐		Verify the drainpipe is covered with geotextile prior to No. 57 aggregate placement.	

☐ 	Task	Reference
☐	Confirm the No. 57 aggregate drainage layer on the membrane is graded and compacted to the planned elevation for roadway material placement.	

AFTER MSE WALLS CHECKLIST

☐ 	Task	Reference
☐	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	When the MSE wall is completely installed, pay 100% of the lump sum. If the MSE wall system is large and is constructed over multiple estimate periods, it may be warranted to pay a percentage of the lump sum.	

Material & Equipment

Class A concrete is used for panel and barrier leveling pads, while Class AA concrete is used for moment slabs and CIP barriers. The concrete used must be supplied by an approved concrete plant and mixed using an approved mix design for the class indicated.

When CIP barriers are not used, pre-cast barriers must be placed on top of the panels. Pre-cast barriers are used as the traffic barrier when the roadway is completed.

Backfill consists of No. 57 aggregate, MSE aggregate, embankment fill, and other approved aggregate fill, as required. Concrete face panels are used as the visible face of the wall and to hold backfill stabilizing straps and concrete barriers in place. Stabilizing straps are steel straps or mesh connected to the back of the panels and embedded in the MSE backfill. They serve to create the binding force that gives the wall its strength.

An impervious membrane is placed on top of the MSE backfill to prevent water infiltration into the backfill. A perforated drainpipe is used in conjunction with the membrane to drain water. Class 4 Geotextile Type A is used to separate the embankment material and the aggregate backfill, as well as to contain aggregate around weep holes, drainpipes, and panel joints.

The contractor uses a combination of equipment, including a excavator, crane, and bulldozer, for excavation and placing panels, backfill, and concrete. A vibratory steel wheel roller is used for compacting backfill material, and a vibratory plate is used for light compaction near the panels.

Mechanical:				
Bulldozer	Crane	Excavator	Vibratory Plate Compactor	Vibratory Steel Wheel Roller

Construction Methods

The wall area is excavated, as required, and the subgrade is compacted to the required density and elevation. A specified granular fill material is placed on the subgrade to the top of the leveling pad excavation. A leveling pad is then formed and placed. The contractor will survey a line for the bottom row of panels on the leveling pad.

The first row of panels is placed using clamps and bracing to stabilize the panels until the backfill and stabilization straps are placed. MSE backfill, panels, straps, and embankment fill are placed concurrently according to the plans and shop drawings and with the required geotextile to the designated elevation. Often, a leveling pad will be required at the top of the final row of panels to create a level surface for barrier placement.

An impervious membrane and drainpipe are placed on top of the MSE backfill to prevent moisture infiltration and to drain water from the wall. A drainage layer of No. 57 aggregate is placed on top of the membrane and then graded. Concrete and rebar for coping, barrier, and moment slabs are placed according to plans and shop drawings. Roadway plans are used for operations above the drainage layer and/or moment slabs.

Prior to placing concrete, the contractor's PennDOT-certified concrete technician tests the concrete according to the contractor's approved concrete QC plan.

Measuring & Payment Methods

MSE walls are paid as a lump sum item, which is broken into an itemized lump sum breakdown format.

The No. 57 aggregate is measured and paid by the cubic yard as a roadway item.

Excavation for MSE walls is typically measured and paid as Class 3 excavation.

7. PERMANENT SOLDIER PILE WALL

This section addresses the construction of permanent soldier pile walls.

There are a variety of methods and materials used to build permanent soldier pile walls; therefore, the discussion in this section is generalized. For each project, refer to the specific designs, provisions, and specifications required by that project. The two general methods of soldier pile wall construction are top-down and bottom-up:

- **Top-down:** Top-down construction generally occurs when the soldier pile wall will retain existing soil, such as a slope stabilization project. The soldier piles are installed through existing soil, and temporary timber lagging is installed behind the piles while the existing soil in front of the piles is removed and permanent concrete lagging, either precast or CIP, is installed.
- **Bottom-up:** Bottom-up construction generally occurs from an existing ground surface, where new fill will be constructed behind the wall, either during or after the construction of the wall. Temporary lagging is typically not required in bottom-up construction.

☐ Review  Documentation Required

BEFORE PERMANENT SOLDIER PILE CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that shop and working drawings, material certifications, mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Review restrictions on excavation depth permitted prior to placing the initial or additional excavation support. Support systems are placed concurrently with the excavation.	PPCC
☐ 	Ensure that the contractor has the required experience, per the special provisions.	
☐ 	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC
☐	Confirm materials are inspected for damage and compliance with the certifications and design prior to their use.	

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☐		Task	Reference
☐		Certify that fences, barriers, or other approved methods are used to isolate the excavation safely.	
☐		Verify if lagging has architectural treatment and protective material (e.g., anti-graffiti, sealers, paint) as indicated.	

DURING PERMANENT SOLDIER PILE WALL CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Reference the eConcrete app, if applicable, and record sketches, testing, and any other required information. Also record the total depth of drilling for each pile location, as well as the depth to rock, if applicable, and the total length of each pile in the PSA.	eConcrete
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan, so test results are within specified limits.	eConcrete MCDocs
☐		If the design includes anchors, ensure testing is performed and documented.	
☐		Ensure all work is strictly complied with the contract, shop, and working drawings due to the numerous safety issues associated with large excavations.	PPCC
☐		Verify that drilled shafts for each pile location reach the minimum indicated depth.	
☐		When soldier piles are designed to be supported in bedrock, confirm the actual top of rock elevation is at or above the estimated top of rock elevation indicated. If bedrock is encountered below the estimated top of rock elevation, the inspector shall notify the IIC, who will notify the District SCE for guidance before placing piles.	
☐		Ensure soldier piles are installed to the required design depth to allow for safe and proper wall construction. The bottom portion of the piles is encased in concrete or aggregate, according to the plans.	
☐		Verify the space between the lagging and the excavated earth face is kept to a minimum. If necessary, fill is placed behind the installed lagging to eliminate earth movement or failure (sudden earth	

☐ 	Task	Reference
	movements or failures in this area may overcome the strength of the lagging).	
☐	Confirm anchors or tiebacks are installed and tensioned following the project-specific sequence.	
☐ 	Ensure that post-tensioning and pull testing are performed on anchors, as required by PUB 408 Section 1108, the special provisions, and the shop drawings.	PPCC
☐ 	Verify that all concrete and grout testing, placement, and curing are performed and documented as required.	
☐	Confirm rebar, if applicable, is placed as indicated.	
☐	When precast concrete lagging is used, monitor the interface of the precast panels and the soldier piles. The lagging must be in full direct contact with the soldier piles to allow the system to act compositely, evenly distributing the load from the lagging to the soldier piles.	
☐	Ensure drainage is installed at the proper location in the wall construction.	
☐	Verify that excavations are adequately dewatered.	

AFTER PERMANENT SOLDIER PILE WALL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete

Material & Equipment

Soldier piles are typically steel W-beam or H-pile sections. Additional structural steel supports and/or whalers are generally required for locations with anchors or tiebacks.

CIP concrete is often indicated to construct a caisson at the base of each soldier pile. CIP concrete may also be indicated for lagging between piles, facing in front of piles, and/or as a cap beam on top of the piles. Precast concrete lagging panels may also be indicated.

Other related materials, such as grout, slurry, mortar, and shotcrete, may also be indicated.

Wood may be used for lagging, bracing, and formwork.

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The contractor uses equipment such as cranes, drill rigs, excavators, front end loaders, and augers for placing construction materials, including piles, temporary and permanent lagging, forms, concrete, rebar, and anchors or tiebacks. Tensioning anchorage systems may require the use of hydraulic jacks. Pumps and other devices may be used for dewatering.

Mechanical:				
Auger	Crane	Drill Rig	Excavator	Front End Loader
Hydraulic Jack	Water Pump			
Testing/Inspection:				
Pressure Gauge System				

Construction Methods

The contractor submits shop drawings for approval prior to the construction of the soldier pile wall. A drilled caisson installation plan may also be required.

Piles are installed to the required depths by placing them in drilled shafts or driving them through existing soil using a pile hammer. Piles placed in drilled shafts are secured in position, and the drilled shafts are filled with concrete, aggregate, or another material as indicated.

For bottom-up construction, permanent lagging is constructed, as indicated, and the wall is backfilled. In top-down construction, excavation of the existing soil begins at the top of the wall.

Temporary timber lagging is often placed behind the soldier piles as the excavation progresses. The contractor should not excavate more than a few feet at a time to allow for the lagging to be installed and minimize the potential for collapse.

When excavation is complete and all temporary lagging is installed, permanent concrete lagging is constructed. Backfill may be required between the existing soil and temporary timber lagging, between the temporary timber lagging and permanent concrete lagging, or both. After the permanent concrete lagging is complete, a protective coating is applied if indicated.

Drainage is installed at various stages of the wall's construction, as indicated. Weep holes are commonly placed in the concrete lagging panels to allow for drainage.

Measuring & Payment Methods

Soldier pile walls are paid as a lump sum item.

8. CONCRETE REPAIRS (SEC. 1017, 1040, 1041, & 1091)

This section addresses typical concrete repairs encountered during construction. These concrete repairs include the following: concrete bridge deck repair, scarification, epoxy injection crack repairs, and pressure mortar pointing and surfacing. The following sections outline the general considerations and requirements associated with repairing concrete during construction.

Concrete Bridge Deck Repair

This section addresses the removal and patching of deteriorated, spalled, or unsound concrete on a bridge deck, as determined by the Department Representative. These repairs are for bridge decks without an overlay or prior to placement of an asphalt or epoxy overlay. This work also applies to approach slabs and barriers when indicated or directed and per PUB 408 Section 1040. There are three types of concrete bridge deck repairs:

- 1) **Type 1** repairs are shallow repairs that do not expose the top mat of reinforcement in the deck. Type 1 repairs are rarely performed and only applicable when a latex or polyester polymer concrete overlay is indicated without hydrodemolition. In these instances, the overlay material is used to repair the Type 1 areas as part of the overlay. Type 1 repairs for all other scenarios are made as Type 2 repairs.
- 2) **Type 2** repairs are deeper than Type 1 and expose only the top mat of reinforcement in the bridge deck. Existing concrete in a Type 2 repair area is removed to provide a minimum of $\frac{3}{4}$ -inch clearance around all reinforcement in the top mat of the repair area, regardless of concrete deterioration.
- 3) **Type 3** repairs are used when unsound concrete removal exposes the bottom mat of reinforcement or if the full depth of the deck is unsound. Type 3 repairs are always performed at full depth. Type 3 repairs are also specified when unsound concrete extends to the top of adjacent box beams, even when a single mat of deck reinforcement is present.

Scarification

This section addresses the scarification of an existing concrete bridge deck in preparation for placing concrete or mortar-wearing surface or before performing hydrodemolition surface preparation, in accordance with PUB 408 Section 1041. The contractor shall verify rebar clearance prior to scarification. Notify the IIC if rebar is damaged during scarification; stop operation immediately.

Epoxy Injection Crack Repairs

This section addresses preparing and sealing cracks in concrete with an epoxy resin mixture, excluding overhead sealing, in accordance with PUB 408 Section 1091.

Pressure Mortar Pointing & Surfacing

This section addresses the process of pressure pointing and grouting of concrete, masonry, and steel members in accordance with PUB 408 Section 1017.

Mortar applied under pressure provides a finishing coat for concrete and masonry members and a protective covering for steel members.

☐ Review  Documentation Required
BEFORE CONCRETE REPAIRS CHECKLIST

☐ 	Task	Reference
Concrete Bridge Deck Repair		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Verify conceptual repair areas are as indicated on the contract plans. Ensure the contractor sounds the structural components to determine the limits of repair areas in the field.	MCDocs
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Review and ensure that power-driven hand tools to be used meet the requirements of PUB 408 Section 1040.	
☐	Confirm protective shielding is in place if needed.	
☐ 	Confirm the contractor's PennDOT-certified concrete technician has tested the concrete in accordance with the specifications and the concrete QC plan, so test results are within the specified limits.	ECMS MCDocs
Scarification		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the existing deck is surveyed for cracks before scarification per PUB 408 Section 1041 specifications.	
☐	Confirm the contractor verifies rebar clearance before scarification.	
☐	Verify the submittal for acceptance of the proposed method and equipment used for the scarification of concrete surfaces.	
☐	Review and ensure that power-driven hand tools to be used meet the requirements of PUB 408 Section 1040.	
☐ 	Confirm that the required compressive strength of 3300 psi has been attained before the scarification of new concrete surfaces.	
Epoxy-Injection Crack Repairs		

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☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the area to seal has been marked out.	
☐		Verify the surface seal has sufficiently hardened prior to injection per PUB 408 Section 1091 specifications.	
☐		Confirm the weather conditions conform to PUB 408 Section 1091 specifications.	
☐		Review manufacturer's data for material and procedures prior to beginning work.	
Pressure Mortar Pointing & Surfacing			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Prior to mortar placement, ensure any reinforcement mesh or rebar used is placed with the proper spacing, laps, and clearances as required, per PUB 408 Section 1017 specifications.	
☐		Verify air and surface temperature are within required tolerances prior to and during mortar placement, as specified in PUB 408 Section 1017.	
☐		Confirm the area to be treated is clean, and free of debris, grease, or other foreign material that may prevent effective bonding of the material per PUB 408 Section 1017.	

DURING CONCRETE REPAIRS CHECKLIST

☐		Task	Reference
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
Concrete Bridge Deck Repair			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the weather conditions conform to specifications.	PPCC
☐		Make sure power-driven hand tools meet the requirements of PUB 408 Section 1040.	

Section 1000: Structures

☐		Task	Reference
☐		Ensure proper shielding, if required, is placed to prevent debris from falling below the deck.	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Verify existing reinforcement is coated with an approved epoxy paint.	MCDocs
☐		Confirm a minimum of ¾ inch clearance is provided around rebar for proper concrete bonding, per PUB 219M BC Standard 783M.	
☐		Ensure a proper concrete bonding compound meeting PUB 408 Section 1040 specifications is used prior to concrete placement.	
☐		Verify that proper curing procedures are used in concrete placement, meeting PUB 408 Section 1040 specifications.	
☐		Confirm patch areas are cleaned to remove remaining debris and loose materials per PUB 408 Section 1040 specifications. Exposed rebar is cleaned by abrasive blasting to remove all corrosion. Oil-free compressed air is used to clean the repair areas.	
☐		When formwork is required, ensure forms are strong enough to prevent deformation under concrete load and that all drip notches and chamfers are included per PUB 408 Section 1040 specifications.	
☐		Verify concrete patches are placed before overlay and have sufficient time to stiffen to prevent deformation under overlay load, per PUB 408 Section 1040 specifications.	
☐		Confirm concrete patches are water blasted to remove laitance prior to placement of an overlay per PUB 408 Section 1040 specifications.	
☐		Ensure damaged or heavily corroded rebar is removed and replaced per PUB 408 Section 1002.	
Scarification			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure scarification is done only to the depth and dimensions indicated by the plans or as directed by the inspector.	MCDocs
☐		Verify equipment used is in accordance with PUB 408 Section 1041.	

☐		Task	Reference
☐		Verify debris is removed and disposed of properly at the end of each workday. Flushing of debris is not permitted.	
Epoxy Injection Crack Repairs			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure surfaces are thoroughly cleaned and unsound concrete is removed.	
☐		Verify the ambient air and concrete temperature is 50F or higher, per PUB 408 Section 1091 specifications.	
☐		Confirm the epoxy resin system is mixed per the manufacturer's instructions.	PPCC
☐		Ensure the surface along the length of the crack and around the port is sealed per PUB 408 Section 1091 specifications.	
☐		Verify the injection ports are glued into place according to the manufacturer's recommended spacing.	
☐		Ensure injection proceeds from the lowest port to the highest and the crack is filled per PUB 408 Section 1091 specifications.	
Pressure Mortar Pointing & Surfacing			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure pressure, velocity, and moisture content are uniform during application and are measured with a velocity meter attached to the gun nozzle. Pressure may be increased due to lift and/or length of hose as needed to maintain application parameters. See PUB 408 Section 1017 specifications.	
☐		Verify mortar is placed as specified (e.g., layer thicknesses, dimensions) per PUB 408 Section 1017 specifications.	
☐		Confirm foreign material trapped by previous mortar layers is removed before adding additional layers.	
☐		Ensure areas near treatment sites are protected from rebounding material.	
☐		Verify the area is cured as required, following approved concrete curing methods.	PPCC

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☐		Task	Reference
☐		Confirm backfill is placed as required, using approved backfill methods in PUB 408 Section 1017.	
☐		Ensure the contractor makes a color sample if required by the special provisions.	MCDocs
☐		Verify if strength samples are required.	MCDocs
☐		Ensure only approved materials, such as ties, clips, anchor bolts, and chairs, are used to secure rebar.	
☐		More than one layer of reinforcement may be required; however, ensure excessive reinforcement layers that may create a plane of weakness in the treated area are avoided. Avoid excessive fabric layers, which may create planes of weakness or internal stresses. See PUB 408 Section 1017 specifications.	
☐		Verify that work is performed under the supervision of an experienced pressure gun foreperson per PUB 408 Section 1017 specifications.	

AFTER CONCRETE REPAIRS CHECKLIST

☐		Task	Reference
Concrete Bridge Deck Repair			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Obtain certification for the concrete bonding compound and tickets for patching materials.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
Scarification, Epoxy Injection Crack Repairs, & Pressure Mortar Pointing & Surfacing			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Concrete Bridge Deck Repair

Prior to patching, a concrete bonding compound is applied in the areas to be repaired unless a latex-modified concrete (LMC) overlay is indicated. Class AAAP concrete accelerated structural

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concrete (ASC) LMC, or an accepted bag mix, is used for patching. Class AAAP or ASC concrete must be from an approved concrete plant and mixed using an approved mix design for the class indicated.

Power-driven hand tools, such as pneumatic hammers, triple-head tampers, and other mechanical chipping devices, may be used in removing deteriorated areas. PUB 408 Section 1040.3 contains restrictions for the sizes of equipment used for removal.

Abrasive blasting machines are required to clean any exposed reinforcement to clean white metal before applying epoxy paint. Air compressors are also required to ensure that all abrasive blast material and other debris are removed from the repair areas.

An approved shielding system to catch falling debris may be required. Formwork may also be required.

If concrete is used, the contractor must have the required testing equipment.

Scarification

Equipment, such as concrete saws and pneumatic hammers, conforming to specifications outlined in PUB 408 Section 1041, may be used for areas near parapets and scuppers. A self-propelled scarification machine, meeting the criteria of PUB 408 Section 1041, may be used for the bridge deck. Power brooms and vacuums may be used to remove debris.

Epoxy Injection Crack Repairs

Materials for this item include epoxy resin, surface seal (as recommended by the resin manufacturer), and injection fittings.

To inject cracks, the contractor uses a hand-held injection gun, pressure pot, injection machine, or other method as accepted by the manufacturer, as well as various hand tools.

Pressure Mortar Pointing & Surfacing

Materials used include grout, reinforcement, ties, clips, and anchor bolts.

For mortar placement, the contractor uses equipment such as mortar pressure guns, air compressors, heaters, and velocity meters.

Mechanical:				
Abrasive Blasting Machine	Aerial Lift	Air Compressor	Concrete Saw	Epoxy Injection Machine
Ground Heater	Pneumatic Hammer	Power Broom	Self-Propelled Scarification Machine	Street Sweeper
Velocity Meter				
Hand Tools:				
Chipping Hammer	Concrete Bullfloat	Epoxy Injection Gun	Field Marking Paint	Mortar Pressure Gun
Shovel	Triple-Head Tamper	Wrench		

Testing/Inspection:				
Caliper	Chain Drag	Concrete Testing Equipment	Tape Measure	

Construction Methods

Concrete Bridge Deck Repairs

The contractor begins by sounding the deck in the presence of the inspector to determine areas of unsound concrete. The inspector will mark out the limits of the repair areas. The contractor saw cuts the perimeter of the areas requiring repair, then removes the deteriorated concrete using power-driven hand tools. Sand or water blasting is used to remove loose chips of concrete on exposed rebar or existing surfaces. Exposed reinforcement is abrasive blasted to clean white metal and coated with epoxy paint.

Once the deteriorated concrete is removed, any required rebar and formwork are placed. The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan. The concrete bonding compound is placed (if applicable), and the area is patched using the materials listed above.

Scarification

The contractor scarifies the area around scuppers and parapets by saw cutting, pneumatic hammer chipping, and/or tampers. A self-propelled scarifying machine is used on the remaining deck. Existing concrete is removed uniformly up to 1/4" deep with each pass of the scarification equipment when hydrodemolition is not indicated and in 1/4" to 1/2" uniform depth passed when hydrodemolition is indicated. Do not scarify within 1/2" clearance of the top mat of the reinforcement bars in the deck. At the end of each day, the contractor removes debris from the work area.

Epoxy Injection Crack Repairs

The inspection staff marks out the area to seal. Surfaces are thoroughly cleaned, and any unsound material concrete is removed. Injection ports are placed according to the manufacturer's recommendations; cracks may need to be beveled to place ports. The surface is then sealed along the length of the crack and around the port.

The contractor mixes the epoxy resin system according to the manufacturer's instructions. Once the surface seal has hardened, the cracks are injected with the sealer, starting at the lowest port and working upward. Once a port is filled, it is plugged, and the contractor moves to the next higher port. The operation is complete when the crack is filled.

Pressure Mortar Pointing & Surfacing

The contractor cleans the area to be treated with air, water, sandblasting, hand scraping, or similar methods. Reinforcement is then placed as required.

Grouting is accomplished by placing one layer of grout at a time using a pressure grout gun. The final main coat is smoothed with hand trowels, given another thin coat of grout, and then, if directed, given a smooth, brushed finish. Treated areas are cured as required.

When applicable, backfill is placed over the treated areas.

Measuring & Payment Methods

Concrete Bridge Deck Repair

This item is measured and paid by the square foot.

Scarification

This item is measured and paid in square yards per each $\frac{1}{4}$ or $\frac{1}{2}$ inch increment of depth.

Epoxy Injection Crack Repairs

This item is paid by the linear foot or as a predetermined amount. The materials are not paid as stored material.

Pressure Mortar Pointing & Surfacing

Surfacing is measured and paid in square feet. Pointing is measured and paid by the linear foot.

9. CEMENT CONCRETE CONSTRUCTION

This section addresses elements common to the construction of most concrete structures. These elements typically include concrete formwork, falsework, reinforcement bars (rebar), concrete placement, and concrete curing in accordance with PUB 408 Section 1001. The following sections outline the general considerations and requirements associated with each of these elements.

Concrete Formwork & Falsework

This section addresses the construction of concrete formwork and falsework. Formwork is any temporary structure used to retain and mold plastic or fluid concrete until it achieves sufficient strength to retain its shape. Formwork is vertical and used to construct walls, columns, piers, abutments, and other vertical concrete surfaces.

Falsework is any temporary structure used to support vertical construction loads until the permanent structure becomes self-supporting. Temporary construction loads include, but are not limited to, structural elements being erected, plastic or fluid concrete, reinforcement, equipment, and people.

Reinforcement Bars (Rebar)

This section addresses the installation requirements of reinforcement bars (rebar) on a structure. Rebar is a steel reinforcing rod in concrete.

Placing & Finishing Concrete

This section addresses the placement and finishing of concrete for a structure or structural element.

Curing & Protection of Concrete

This section addresses methods of curing concrete. Curing is one of the key elements in quality concrete construction, as it directly affects concrete strength, appearance, and durability. Curing is best accomplished by maintaining a stable environment, in terms of temperature and moisture, for a required period after the concrete is placed.

☐ Review

 Documentation Required

BEFORE CEMENT CONCRETE CONSTRUCTION CHECKLIST

☐ 	Task	Reference
Concrete Formwork & Falsework		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure the approved plans and shop drawings for formwork/falsework, with load-bearing requirements for elements such as piers caps, overhangs, arches, and box culverts, are obtained prior to the start of formwork placement.	MCDocs PPCC

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☐		Task	Reference
☐		Verify the contractor has laid out the formwork grade, alignment, and dimensions using required surveying methods and that a copy of the survey shots is on file.	PPCC
☐		Confirm the forms are clean and oiled, when applicable, before use and that the formwork that is reused has no obvious defects.	
☐		Ensure stay-in-place (SIP) deck forms and included hardware have certifications, are free from damage, and are constructed according to the approved shop drawings.	ECMS MCDocs PPCC
☐		Verify SIP forms are cut using saws, shears, and similar tools in the field but cannot be cut by burning. Ensure any damage to SIP coatings (not including weld burns) is repaired using approved methods.	MCDocs PPCC
☐		Confirm Accepted SIP drawings are reviewed for the direction of pan placement relative to the anticipated direction of the pour.	MCDocs PPCC
☐		Ensure deck, overhang, and other load-bearing form construction allow for camber and settlement after loading.	MCDocs
☐		Verify forms are secured and strong enough to withstand concrete loading and vibration with tolerable loss of alignment, dimension, shape, and mortar leakage.	
☐		Do not use support systems that will cause unacceptable overstress or deformation to permanent bridge members.	
☐		Ensure chamfer, architectural lining, rebar, bulkheads, and joints are secured before concrete placement.	MCDocs
☐		Verify parapets are formed with fixed steel or wooden forms or by methods of slip forming. When slip forming is used, verify a QC plan has been submitted and approved before placement. Refer to PUB 408 Section 1001 for specified durations required for formwork that is to stay in place after concrete placement.	MCDocs PPCC
☐		Ensure steel spacers used to secure formwork during concrete placement will be embedded into the concrete, which will leave no material within 1 ½ inches of the surface as required.	
☐		Obtain the contractor's Written Certification that any falsework has been installed as per design and certified by a PE.	
☐		Confirm formwork accommodates curing procedures, such as heat, blankets, wet burlap, and flood curing.	

□		Task	Reference
Reinforcement Bars (Rebar)			
□		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Provide acceptance of in-place reinforcement bars before concrete is placed.	
□		Ensure rebar is free of dirt, oil, rust, and other foreign materials before placement.	
□		Confirm delivery tags, structure plans, certifications, and field measurements agree with one another.	MCDocs
□		Verify that damaged rebar has either been repaired with approved methods or discarded. Minor incorrect bends may be corrected; however, the use of heat is not permitted.	PPCC
□		Ensure rebar is stored off the ground with identification tags attached and protected as necessary.	
Concrete Placement			
□		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Watch applicable training videos for bridge deck pre-placement operations, bridge deck testing placement and pumping, and Bridge Deck Finishing.	Construction Training Videos
□		Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
□		Ensure the concrete plant has been authorized to release the concrete.	
□		Confirm the bearing area for the foundation has been approved and is per PUB 408 Section 1001 specifications.	
□		Ensure the formwork has been set and rebar and other embedded elements are in place and checked by the inspection staff.	
□		Verify weather conditions, air temperatures, and forecasts are within the requirements of PUB 408 Sections 501 and 1001 to ensure placement of concrete is feasible for that day.	
□		Ensure concrete does not come into contact with aluminum unless the aluminum surface is coated with an acceptable coating.	

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☐		Task	Reference
☐		Verify that adjacent concrete is not placed for at least 24 hours at construction joints where the rebar extends through the joint, per PUB 408 Section 1001 specifications.	
☐		Ensure concrete placed in superstructures is completed per the bridge deck placement plan unless specified otherwise. See PUB 408 Section 1001 for details regarding concrete placement in certain elements of the superstructure, bridge decks, concrete arches, and box culverts.	PPCC
☐		Confirm concrete is finished using conventional methods, tooled methods, or as indicated on the contract drawings and PUB 408 Section 1001.	MCDocs
Concrete Curing			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that a QC plan is approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Membrane Spray Cure: Ensure that materials used are certified for use as a curing agent or method.	ECMS
☐		Water Cure: Verify burlap is saturated for 48 hours before placement on the concrete and that saturation is maintained as required by the contractor for the entire curing period, per PUB 408 Section 1001 specifications.	
☐		Water Cure: Ensure adequate water storage is provided and the plan to monitor/refill tanks is accepted.	
☐		Temperature Requirements: Verify materials used for heating are available and in working condition before concrete placement and a backup heating system is readily available.	PPCC
☐		Cylinder Curing: Verify all requirements provided by ACI/PennDOT and the approved concrete QC plan are followed for cylinder curing.	PPCC

DURING CEMENT CONCRETE CONSTRUCTION CHECKLIST

☐		Task	Reference
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	

□		Task	Reference
Concrete Formwork & Falsework			
□		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Ensure forms are checked during concrete placement for loss of dimension and alignment.	
□		Verify wooden spreaders used inside the forms are removed during concrete placement.	
□		Confirm that steel spacers utilized to secure formwork during concrete placement are embedded within the concrete, allowing no material within 1 ½ inches of the surface as required.	
□		Ensure epoxy bonding material is placed per the manufacturer's specifications and PUB 408 Section 1001, giving special attention to the age of the concrete.	
□		Confirm that formwork is not placed on muddy or frozen ground.	
□		Verify formwork accommodates drainage from storm runoff.	
Reinforcement Bars (Rebar)			
□		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Ensure additional bridge deck rebar in the negative moment region over the pier/diaphragm is placed as detailed.	MCDocs
□		Verify the splice lengths of the bridge deck rebar are correct, as shown on the contract drawings. Splice lengths within negative and positive moment regions for continuous span construction are longer than normal splices.	MCDocs
□		Confirm mechanical splice systems for phased construction are tested and installed per PUB 408 Section 1002.	MCDocs
□		Ensure rebar is placed according to structure plans, with close attention to proper location, size, spacing, and coatings, as well as top, bottom, and side clearances.	MCDocs
□		Verify that splices are the correct length and at the correct locations, according to structure plans and as required by PUB 219M BC Standard 736M.	MCDocs
□		Welded and mechanical splices are to only be used when indicated by the structure plans or approved by the engineer. Mechanical	MCDocs

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☐		Task	Reference
		couplers require testing and approval before concrete placement. The Representative selects four mechanical splices for each size of reinforcement and submits them to the Laboratory Testing Section (LTS) for testing in accordance with PUB 408 Section 1002.2. Care should be taken to assemble the splices for testing according to manufacturer requirements.	
☐		Confirm splices are placed so as not to compromise spacing or clearances.	
☐		Ensure the epoxy or galvanized coating for mechanical splice systems matches the coating system of the bars being spliced.	ECMS
☐		Verify rebar ties are placed at all perimeter intersections and all intersections on the top mat of bridge decks and in bridge barriers. For other intersections, when bar spacing is greater than or equal to 12 inches, tie all intersections; when bar spacing is less than 12 inches, tie all intersections or alternate intersections in each direction to provide a staggered tie layout.	
☐		If stirrups in precast bridge elements are not coated during fabrication, ensure the exposed portion of the bars is coated.	
☐		Ensure rebar is tied with plastic-coated wire, epoxy tie wire, metal clips, or plastic clips in a manner to avoid movement during and after concrete placement.	
☐		Verify rebar chairs are galvanized, plastic coated, or epoxy coated.	
☐		Confirm rebar is supported with blocks of the same type of concrete if the concrete is placed directly on the ground.	
☐		Do not weld rebar.	
Concrete Placement			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure concrete is not placed on frozen foundation material, in formwork containing frost, around rebar that is covered in frost, or pile shells surrounded by ice or frozen ground per PUB 408 Section 1001 specifications.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs

Section 1000: Structures

☐		Task	Reference
☐		Confirm concrete is placed in a manner that prevents segregation. Concrete that is segregated, too wet for use, or does not have uniform consistency is removed from the forms and discarded.	
☐		Ensure concrete is not dropped more than 5 feet during placement, as per PUB 408 Section 1001 specifications.	
☐		Verify successive batches of concrete are placed in the formwork within 30 minutes and temperatures are within 20F of adjacent batches, as per PUB 408 Section 1001 specifications.	
☐		Confirm concrete is placed in lifts that do not exceed 15 inches, as per PUB 408 Section 1001 specifications.	
☐		Ensure concrete is placed in the formwork as close to its final position as possible to minimize working or flowing the concrete.	
☐		Verify water or curing agents are not used to aid in finishing concrete, per PUB 408 Section 1001 specifications.	
☐		Confirm mechanical vibrators are in good working condition, the vibrator placement into the concrete does not exceed 3 feet spacing, and the vibrator is not used to move concrete within the formwork, per PUB 408 Section 1001 specifications.	
☐		For concrete placed where standing water is present, refer to PUB 408 Section 1001 for additional details.	
☐		Ensure the connecting surface of hardened or existing concrete is clean, free of laitance, and loose foreign material before adjacent concrete is placed.	ECMS PPCC
☐		Verify contact surfaces are coated with an approved bonding compound as per the manufacturer's recommendations before placement of adjacent concrete.	ECMS PPCC
☐		Confirm cool/cold weather protection is applied to concrete in accordance with PUB 408 Section 1001.	
Concrete Curing			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure curing equipment is available for use directly after the concrete is placed.	

☐		Task	Reference
☐		Verify curing materials are placed as soon as concrete is finished and sufficiently hardened.	
☐		Confirm thermometers are placed on the finished concrete to verify temperatures during the curing period. During cool or cold weather, preheat thermometers and verify initial high/low temperatures. If the air temperature is below 50F and/or below concrete temperatures, a false reading could occur.	
☐		Membrane Spray Cure: Ensure the spray cure is applied in two coats: the first directly after finishing or form removal and the second after the first application sets.	
☐		Membrane Spray Cure: Verify that the spray cure is not placed on bridge decks, anything to be treated with a protective coating, or on construction joints. These areas must be water-cured.	
☐		Membrane Spray Cure: Confirm an intermediate molecular film is applied to the bridge deck after finishing is complete to retain moisture until the water curing is applied for decks that are manually textured. It should not be used as an aid in finishing the concrete.	
☐		Membrane Spray Cure: Ensure exposed rebar is protected before a spray cure is applied near it.	
☐		Water Cure: Ensure concrete sets enough to prevent marking when water curing is applied.	
☐		Water Cure: Verify that double-thick burlap is used for water-curing bridge decks for 14 days. White poly sheeting should not be used on bridge decks for the first 14 days unless cool or cold weather conditions occur. After 14 days of water cure and compressive strengths are met, place white polyethylene sheeting for seven days in accordance with PUB 408 Section 1001 specifications.	
☐		Water Cure: Confirm curing materials are secured so they are not lifted or displaced during curing.	
☐		Temperature Requirements: Ensure high/low thermometers are used to check and document curing temperatures.	
☐		Temperature Requirements: Ensure concrete is covered and protected in accordance with PUB 408 Section 1001. When concrete is not covered or protected, the curing temperature is considered equal to the air temperature.	
☐		Temperature Requirements: When concrete curing temperatures drop below 50F for normally cured concrete and below 40F for a flood-cured footing, ensure that the day is not counted as a curing	

☐		Task	Reference
		day. See PUB 408 Section 1001.3 for special curing temperature requirements for the bridge deck and other “at-grade” elements.	
☐		Temperature Requirements: Reject concrete work when curing temperatures drop below 35F per PUB 408 Section 1001 specifications.	
☐		Temperature Requirements: Ensure materials used for heating are available and in working condition prior to concrete placement and a backup heating system is readily available.	ECMS
☐		Temperature Requirements: Verify cold weather temperatures are taken inside the formwork and protective housing.	
☐		Temperature Requirements: Confirm insulation mats are placed tightly and without tears around the formwork and projecting rebar so that heat and moisture are not lost.	
☐		Temperature Requirements: Ensure when using insulation on the deck, the underside is enclosed and preheated in accordance with PUB 408 Section 1001 specifications.	
☐		Cylinder Curing: Ensure a constant desired water temperature of 73F plus or minus 3F is maintained for acceptance cylinders cured in a lime bath.	
☐		Cylinder Curing: Verify QC cylinders cured on site are cured in the same manner as the concrete they represent in accordance with PUB 408 Section 704.	
☐		Cylinder Curing: Confirm a high/low thermometer is used to monitor and record cylinder temperatures.	
☐		Cylinder Curing: Ensure concrete curing continues until the required cylinder compressive strengths are attained and the minimum time requirements are met.	

AFTER CEMENT CONCRETE CONSTRUCTION CHECKLIST

☐		Task	Reference
Concrete Formwork & Falsework			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure holes in placed concrete from form ties and bolts are patched with an approved non-shrink grout.	

□		Task	Reference
Reinforcement Bars (Rebar)			
□		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
Concrete Placement			
□		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
□		Ensure surface imperfections and formwork holes are patched, as necessary, after formwork removal.	
Concrete Curing			
□		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
□		Membrane Spray Cure: If the spray cure is damaged during the curing period, the spray cure should be reapplied.	

Material & Equipment

Concrete Formwork & Falsework

Formwork is vertical and used to construct walls, columns, piers, abutments, and other vertical concrete surfaces. Forms are made from steel or wood. Architectural formwork may be required by special provisions for some projects.

The contractor uses cranes, aerial lifts, excavators, and other lifting equipment in placing formwork. Ties, spreaders, braces, bolts, chairs, and walers are used to hold the formwork in place.

Falsework is any temporary structure used to support vertical construction loads until the permanent structure becomes self-supporting. Temporary construction loads include, but are not limited to, structural elements being erected, plastic or fluid concrete, reinforcement, equipment, and people. Falsework drawings and design computations are required to be signed and sealed by a PE and registered in the Commonwealth, and a certification of falsework adequacy is to be submitted before placing loads on the falsework.

Reinforcement Bars (Rebar)

Rebar may be epoxy-coated, galvanized, or uncoated. It should be inspected as it is delivered for damage and to ensure that the specifications, such as size, length, and bar mark, are consistent

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on delivery tags, certifications, and structure plans. Delivery tags should remain on the rebar until it is placed.

The rebar must be stored off the ground on blocks. When storing for more than two months, cover with a protective material to prevent deterioration of epoxy coating due to exposure to sunlight. Provide ventilation to prevent condensation from forming under the covering.

Placing & Finishing Concrete

Concrete placed must be supplied from an approved concrete plant and mixed using an approved concrete mix design for the class of concrete indicated.

The contractor uses a variety of materials and equipment for concrete placement. These include concrete testing equipment, a concrete bucket, concrete hopper, tremies, and concrete vibrators, as well as various hand tools, including floats, rakes, and shovels. The contractor also uses lifting equipment that can handle the loads of placing concrete, such as cranes, excavators, concrete pump trucks, and conveyors.

Concrete Curing

Curing is best accomplished by maintaining a stable environment, in terms of temperature and moisture, for a required period after the concrete is placed.

Materials for the work include those to maintain moisture, such as water, membrane spray cure, burlap, polyurethane, and weeper hoses. Blankets, straw, foam insulation, heaters, plastic, and radiant heat may be used for maintaining temperatures during cool and cold weather curing.

Curing boxes, lime baths, and storage areas are required for the protection and curing of concrete cylinders, and high/low thermometers are required to accurately maintain proper curing temperatures for cylinders and placed concrete.

Mechanical:				
Aerial Lift	Concrete Bucket	Concrete Hopper	Concrete Pump Truck	Crane
Excavator	Ground Heater	Tremie		
Hand Tools:				
Concrete Bullfloat	Concrete Rake	Concrete Vibrator	Shovel	
Testing/Inspection:				
Concrete Testing Equipment	Depth Check Gauge	High/Low Thermometer	Probe Thermometer	Smart Level

Construction Methods

Concrete Formwork & Falsework

The contractor submits required falsework drawings for approval to the District SCE before the construction of any load-bearing falsework.

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The formwork is placed using alignment, grade, and other required dimensions set by the contractor's surveyor. Bracing, ties, and walers are used to secure the formwork. All materials to be embedded in the concrete are secured to the formwork as required. The formwork is then sprayed with a form-releasing agent. In addition, all load-bearing falsework requires certification from a state-registered PE to ensure that the falsework system has been assembled as shown on the signed and sealed falsework drawings.

After concrete placement, the formwork and falsework are removed according to the specifications, and spray cured is applied if required.

Reinforcement Bars (Rebar)

The contractor uses the delivery tags on the rebar to coordinate placement with the structural plans. Rebar is secured according to the plans, using tie wire, rebar chairs, approved PUB 35 Bulletin 15 or of the material concrete blocks, no greater than 4-inch surface area exposed to the face of placement, or other accepted methods.

Placing & Finishing Concrete

A meeting is held before concrete placement to ensure that all parties involved understand how the placement is to be performed and that the contractor, inspection staff, and concrete supplier are prepared for placement.

NOTE: A pre-placement meeting is required for bridge decks to review the specification, method and sequence of placing deck concrete, QC testing, and method of protective measures to control evaporation rate.

Prior to concrete placement, the contractor sets and properly braces formwork and places all rebar. The contractor's PennDOT-certified concrete technician tests the concrete for air, slump, and temperature in accordance with PUB 408 Section 704 and the approved concrete QC plan. Mixer trucks are checked for yearly calibration. Compression cylinders are molded at a sample location determined by PUB 19 PTM 1 as necessary.

The concrete is placed in the formwork using appropriate lifts and consolidated using a mechanical vibrator. The surface of the concrete is finished, and curing is applied as required. If necessary, cool/cold weather protection is placed over the concrete.

Concrete Curing

Prior to construction, the contractor submits a concrete QC plan for approval. The plan must include targeted curing temperature requirements for placed concrete.

When concrete arrives on the project, the contractor is required to make compressive strength cylinders for QC and acceptance, which are then placed in a curing box for the first 24 hours after they are molded. After 24 hours, the QC cylinders are cured in the same manner as the placed concrete, and the acceptance cylinders are taken to a lime bath.

After concrete is placed for a particular element and all finish work is complete, curing is placed and maintained as required. The contractor may flood cure, place wet burlap and white polyethylene sheeting, apply membrane spray cure, cover with insulation, or apply heat, as required by the weather conditions for that particular concrete placement.

For bridge decks, bridge deck patches, expansion dam blockouts, CIP box culverts at grade, and box culvert distribution slabs at grade only, a double layer of wet burlap is allowed for curing covers unless in cool or cold weather curing conditions.

Measuring & Payment Methods

Concrete Formwork & Falsework

Formwork and falsework are incidental to the concrete placed in the forms.

Reinforcement Bars (Rebar)

Rebar is measured and paid as part of the lump sum or in pounds. A good rule is to pay for all the bars per concrete placement that have been partially or entirely encased in concrete.

Mechanical splice systems are paid as each or lump sum.

Epoxy paint for painting the splice area after assembly is incidental if epoxy-coated reinforcement bars and mechanical splice systems are used.

Placing & Finishing Concrete

Concrete placement is paid by the cubic yard or as a lump sum.

Concrete Curing

Payment for curing is incidental to the placed concrete.

10. PROTECTIVE COATING OF REINFORCED CONCRETE SURFACES (SEC. 1019)

This section addresses the application of protective coatings (sealers) for reinforced concrete surfaces in accordance with PUB 408 Section 1019.

Boiled Linseed Oil

Linseed oil is a blend of boiled linseed oil and solvents. When applied in a thin coating to concrete surfaces, it protects them from winter damage due to freeze-thaw cycling and the effects of de-icing salts. Two applications of the oil compound will protect concrete and increase its resistance to winter damage.

Epoxy Resin

An epoxy coating typically applied to substructure elements after concrete repairs have been performed to protect them from de-icing chemicals.

Penetrating Sealer

Similar to boiled linseed, penetrating sealers are specially formulated to penetrate and seal the concrete surface from damage. These can be applied to substructure elements, bridge decks, and parapets.

☐ Review  Documentation Required

BEFORE PROTECTIVE COATING APPLICATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the area to be sealed is measured and that the amount of material required is calculated.	
☐		Verify the surface is thoroughly clean and dry.	

DURING PROTECTIVE COATING APPLICATION CHECKLIST

☐		Task	Reference
Boiled Linseed Oil			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the membrane-forming compound is not applied to the area where boiled linseed oil is to be applied.	

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☐		Task	Reference
☐		Verify linseed oil is applied to a dry surface as soon as possible after completion of construction, except for bridge decks, for which there is a waiting period of 28 days.	
☐		Ensure linseed oil is only applied when the air and concrete temperatures are between 40F and 95F per PUB 408 Section 1019 specifications.	
☐		Confirm the initial coat is checked for total and uniform coverage, ensuring that the minimum coverage rate of 0.02 gal/square yard is met. Ensure four hours elapse before traffic is permitted as required by PUB 408 Section 1019.	
☐		Record that the second coat is applied 24 hours after the application of the first coat and verify the total and uniform coverage has been achieved. Ensure traffic is not permitted within six hours of the application of the second coat as required by PUB 408 Section 1019.	
Epoxy Resin			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure membrane-forming compound is not applied to areas where resin is to be applied, following PUB 408 Section 503 specifications.	
☐		Verify epoxy resin is applied 28 days after the concrete is placed in accordance with PUB 408 Section 1019 specifications unless otherwise permitted.	
☐		Confirm all surfaces to be sealed are cleaned with a muriatic acid solution, sandblasting, or other acceptable method following PUB 408 Section 1019.	
☐		Ensure resin is only applied when the temperature is between 60F and 90F per PUB 408 Section 1019.	
☐		Verify the initial coat is checked for total and uniform coverage, ensuring that the specified rate of application is met and in accordance with PUB 408 Section 1019.	
☐		Confirm 24 hours elapses between the first and second coats and total and uniform coverage has been achieved per PUB 408 Section 1019.	
☐		Ensure a representative sample of each component will be taken for required tests following PUB 408 Section 1019.	

☐  Task	Reference
Penetrating Sealer	
☐  Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐  Ensure the sealer is applied according to the manufacturer's instructions and PUB 408 Section 1019.2.	
☐  Verify the penetrating sealer is applied after the completion of the specified concrete wet cure period, followed by an initial drying period of a minimum of 14 days after the wet curing period, and the concrete surface is dry.	
☐  Ensure penetrating sealer is applied to exposed concrete surfaces of bridge decks, curbs, sidewalks, divisors, and inside and top surfaces of barrier.	

AFTER PROTECTIVE COATING APPLICATION CHECKLIST

☐  Task	Reference
☐  Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Materials for this process include boiled linseed oil, epoxy resin, and penetrating sealer. To ensure that the material is free of defects, it must be stored in properly sealed containers, not frozen, and each part of a two-component system (those which require mixing) is fully packaged.

These sealers can be applied using hand or power sprayers, brushes, rollers, brooms, or other devices that ensure proper application.

Mechanical:				
Protective Coating Sprayer				
Hand Tools:				
Broom	Brush	Hand Sprayer	Paint Roller	

Construction Methods

The area to be sealed must be clean and free of all foreign debris. When using epoxy resin, the surface must be cleaned with a muriatic acid solution, sandblasting, or other approved methods.

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The process may require one or two coats of sealant, depending on the material used. Typically, the sealer is sprayed on. Boiled linseed oil and epoxy resin should be applied in two coats, with a drying period of 24 hours between coats. When penetrating sealer is used, only one coat may be required; however, follow the manufacturer's instructions for precise application.

Measuring & Payment Methods

Protective coatings are paid as part of the structure lump sum or by the square yard. This measurement can be used to determine the amount of sealant required based on its application rate per square yard.

The Department will pay for additional maintenance and protection of traffic, if necessary, for the application of an additional protective coating to bridge decks experiencing excessive cracking, as specified in PUB 408 Section 110.03.

Payment can be made daily or at the completion of this activity. If applicable, partial payment can be made as agreed to by the contractor and inspection staff. Typically, these materials are not paid as stored materials.

11. BEAM SEAT & BEARING INSTALLATION (SEC. 1050 & 1080)

This section addresses the construction of beam seats on substructures and the placement of bearing pads in preparation for beam placement.

☐ Review  Documentation Required

BEFORE BEAM SEAT & BEARING INSTALLATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify all required shop drawings are approved in PPCC . Review and become familiar with the shop drawings.	ECMS MCDocs
☐ 	Ensure bearing dimensions are per shop drawings and that they are protected from weather and damage from handling during transport and storage.	ECMS PPCC
☐ 	Confirm the jacking procedure is approved, and that all dead loads are in place on the bridge before any beam jacking occurs.	
☐ 	Ensure temperature restrictions are followed when resetting bearings.	
☐	Verify bearings that arrive on-site assembled are not disassembled unless necessary for inspection or installation purposes.	
☐ 	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC

DURING BEAM SEAT & BEARING INSTALLATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Ensure beam seats are constructed per contract drawings as part of the substructure.	MCDocs

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☐		Task	Reference
☐		Verify areas between and around the seats are sloped towards the front face of the abutment to prevent ponding of water.	
☐		Confirm beam seats are within tolerances for elevation, smoothness, flatness, and slope according to PUB 408 Section 1001. Ensure beam seats are ground until the desired tolerances are met.	
☐		Ensure beam seats for neoprene bearing pads have a rough-textured surface in accordance with PUB 408 Section 1001.	
☐		Verify minor depressions from the finishing and grinding of metallic bearings are filled with an approved low-viscosity epoxy applied with a squeegee.	
☐		Confirm that any gaps present after the beams are set on the bearings are remedied according to PUB 408 Section 1080.	
☐		Ensure bearings are placed in the exact position noted in the contract drawings and have full bearing on all surfaces.	MCDocs
☐		Verify bearings are clean when installed.	
☐		Confirm metallic bearing assemblies are bedded on fabric material per PUB 219M BC Standard 756M. Bedding material is not required for elastomeric bearing pads.	
☐		Ensure beams are jacked simultaneously.	
☐		Verify all beams are in their original position after jacking the beams and resetting the bearings.	
☐		Review the approved jacking procedure to ensure what equipment is permitted on the bridge deck during beam resets. No traffic is permitted on the bridge until after the reset unless approved in the jacking procedures.	PPCC
☐		Ensure high-load multi-rotational bearings are lifted by the underside or by designed lifting lugs.	
☐		Verify the guided bearing direction aligns with the structure expansion direction.	MCDocs
☐		When welding sole plates to girders, confirm the temperature of the metal next to the elastomer is controlled per PUB 408 Section 1050.	
☐		Verify under dead load that the upper and lower bearing plates are not out of parallel, when measured edge to edge, by more than the	PPCC

☐ 	Task	Reference
☐	tolerances indicated in PUB 408 Section 1050 and the shop drawings.	

AFTER BEAM SEAT & BEARING INSTALLATION CHECKLIST

☐ 	Task	Reference
☐	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure bearing assembly straps and clamps remain in place until structure movement begins.	

Material & Equipment

Bearings used in the work include elastomeric pads, rockers, rollers, pots, spherical bearings, disc bearings, and sliding plates. Angle grinders, hammers, and epoxy may be used to adjust beam seats to within tolerances.

A survey transit is required to set and verify beam seat elevations, and cranes are often needed to place bearings in their final position. Welders may also be needed for placing certain bearings.

Mechanical:				
Angle Grinder	Crane			
Hand Tools:				
Field Welding Equipment				
Testing/Inspection:				
Feeler Gauge	Smart Level	Survey Transit	Tape Measure	

Construction Methods

The contractor places the concrete for the beam seats, per survey information, during substructure placement. The contractor submits as-built beam seat elevations, stamped by a professional land surveyor (PLS) or PE, for review and acceptance by the SCE. Do not allow beams to be set until they are accepted. The contractor will submit a corrective action plan for beam seats that do not meet the tolerances indicated in PUB 408 Section 1001.

Bearings are placed on the beam seats per shop drawings, and then the beams are placed on the bearings and checked for proper contact between the bearing and the beam. When lift-off conditions are planned, the contractor will jack up the beam so that the bearing may be reset.

Measuring & Payment Methods

Bearings may be paid as each item or as part of the bridge lump sum.

12. ANCHOR BOLTS (SEC. 1050)

This section addresses the installation of anchor bolts in the applicable parts of PUB 408 Section 1050. Anchor bolts are used to connect structural and non-structural elements to concrete.

☐ Review  Documentation Required

BEFORE ANCHOR BOLTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure bolts are galvanized and threaded or swedged to allow for proper bonding between the bolt and the material in which the bolt is placed.	
☐ 	Verify a template is used to set anchor bolts to the correct elevation and alignment. The template is checked carefully for proper dowel positioning prior to placement of the concrete or grout.	
☐ 	Confirm hole clearances and sizes in masonry and sole plates are per PUB 219M BC Standards 755M or 756M and the contract drawings.	ECMS
☐ 	Ensure only approved non-shrink grout is used for placing dowels into pre-formed or drilled holes per PUB 408 Section 1001.	ECMS
☐ 	Verify that drilled and pre-formed holes are constructed larger than the bolt itself. Refer to PUB 408 Section 1050 for hole size requirements.	
☐ 	Record that pre-formed or drilled holes are protected from water entry during freezing weather, ensuring holes are sealed tightly and may also be filled with anti-freeze, sand, or grout that will be removed when bolts are to be placed.	

DURING ANCHOR BOLTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure drilled holes are placed only on abutments and solid piers.	

☐		Task	Reference
☐		Verify holes are clean and dry for grout placement.	
☐		Verify when pre-formed holes are constructed for anchor bolts and anchor bolts are installed after the bearings are installed. A 1-inch diameter threaded grout pipe should be utilized to fill the pre-drilled holes with non-shrink grout per PUB 219M BC Standard 756M.	
☐		Ensure threaded projections of the anchor bolts above the nuts are limited per PUB 408 Section 1050.	

AFTER ANCHOR BOLTS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure projected anchor bolts are painted as soon as practical and according to the constraints of PUB 408 Section 1050, confirming grease, soil, concrete, and other debris were removed prior to painting.	
☐		Verify threads are coated with grease after painting.	

Material & Equipment

Anchor bolts are threaded or swaged, galvanized steel bolts embedded into pier or abutment beam seats. Non-shrink grout is used to place anchor bolts into pre-formed holes.

A concrete drill is needed for drilling anchor bolt holes. Painting equipment may be required to paint the projecting portion of the anchor bolts. Refer to PUB 8 Section 1000.24 for more information.

Mechanical:				
Concrete Drill				

Construction Methods

The contractor may embed or form holes for the anchor bolts during the concrete placement of the substructure unit. Anchor bolt holes may also be drilled after the concrete is placed in abutments and solid piers only. Often, the contractor uses a template to set and hold the anchor bolts to the correct elevation and alignment.

When holes are pre-formed or drilled, the anchor bolts are placed using a non-shrink grout. Placed anchor bolts may need to be cleaned, painted, and greased prior to use.

Measuring & Payment Methods

Anchor bolts may be paid as part of the lump sum bridge, incidental to another bridge item, or as each item.

13. CEMENT CONCRETE SUBSTRUCTURES (SEC. 1001)

This section addresses elements common to the construction of most concrete substructures. These elements typically include footings, abutments, integral abutments, and piers. The following sections outline the general considerations and requirements associated with each of these elements.

Footings

This section addresses the construction of concrete footings. There are three types of footings.

- **Spread footings** are constructed when the existing soil or rock layers at the required footing elevation are strong enough to support foundation pressures. The loads the footing must support, along with the supporting ability of the material at foundation grade, is used in determining the dimensions of the footing.
- **Pile footings** are constructed when the existing soil and rock at the bottom of the footing will not support foundation pressures. Piles, consisting of steel H-sections or steel shells filled with concrete, are constructed to carry the load. These piles are typically 10 feet or longer. The size of the footing is determined by minimal clearance around all piles.
- **Caisson footings** are constructed when core borings show that the depth to sound rock is 15 feet and that the material above this depth is hard enough to interfere with pile driving. Placed under pier columns, caisson footings are generally larger in diameter than the pier columns they support.

Abutments

This section addresses the construction of concrete abutment walls. An abutment is the substructure at the ends of a bridge span or dam supporting its superstructure.

Integral Abutments

This section addresses the construction procedures for constructing an integral abutment structure. An integral abutment structure consists of piles, pile caps, steel or concrete girders, concrete end diaphragms, and deck and approach slabs, all cast monolithically.

Piers

This section addresses the construction of concrete pier sections above the footings. There are a variety of pier types, as well as methods to construct them. This section addresses hammerhead piers, multi-column bent piers, and solid shaft wall-type piers.

☐ Review

 Documentation Required

BEFORE CEMENT CONCRETE SUBSTRUCTURES CHECKLIST

☐ 	Task	Reference
Footings		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Verify that an approved concrete QC plan, mix design, and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Verify excavation is completed to the bottom of the footing elevation, ensuring the contractor supplies footing-grade elevation shots.	MCDocs
☐		Ensure the District SCE or DGE has inspected and approved the bottom of the spread footing elevation before concrete placement, if applicable, per PUB 408 Section 1001 specifications.	
☐		Verify if a coffer dam is required for footings placed within waterways.	MCDocs
☐		Confirm rebar mark, size, type, quality, length, and bending configuration are verified.	MCDocs
☐		Ensure mechanical splices are tested before placing concrete per PUB 408 Section 1002 specifications.	
☐		Confirm forms and rebar are inspected before concrete placement per PUB 408 Section 1001 specifications.	
☐		Verify that the concrete air meters are calibrated biweekly per PUB 408 Section 704 specifications.	
Abutments			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that concrete QC plan, mix design, and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Ensure a minimum of 12 hours elapses between footing placement and abutment wall construction. If the footings are on piles, construction cannot begin until 48 hours have elapsed per PUB 408 Section 1001.	
☐		Prior to construction commencing, if required, ensure PennDOT-approved formwork shop/working drawings are obtained. Upon completion of formwork, ensure written acceptance is obtained from the contractor's engineer, and a copy is placed in the job files before the concrete placement.	PPCC
☐		Confirm rebar mark, size, type, quality, length, and bending configuration are verified.	MCDocs

Section 1000: Structures

☐		Task	Reference
☐		Ensure mechanical splices are tested before placing concrete per PUB 408 Section 1002 specifications.	
☐		Verify concrete air meters are calibrated biweekly per PUB 408 Section 704 specifications.	
☐		Confirm forms and rebar are inspected before concrete placement per PUB 408 Section 1001.	
Integral Abutments			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that concrete QC plan, mix design, and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
Piers			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that concrete QC plan, mix design, and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Ensure shop drawings for cap work are obtained before placement.	PPCC
☐		Confirm work on pier stem sections does not proceed until footing concrete is in place for 48 hours for pile footings and 12 hours for other footings per PUB 408 Section 1001.	
☐		Prior to falsework construction, confirm submitted and approved plans/shop drawings for falsework with load-bearing requirements (for elements such as pier caps) are received, and falsework certification is submitted before loading.	PPCC

DURING CEMENT CONCRETE SUBSTRUCTURES CHECKLIST

☐		Task	Reference
Footings			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 1000: Structures

☐		Task	Reference
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure the contractor has removed water from the excavation and has measures in place to prevent water from entering the excavation per PUB 408 Section 1001.	
☐		Ensure the District SCE is notified to inspect the foundation area for bearing capacity before concrete placement per PUB 408 Section 1001.	
☐		If additional excavation is necessary to achieve a suitable foundation area, document the dimensions of the undercut for payment per PUB 408 Section 1001 specifications.	
☐		Ensure formwork is constructed to match the contract drawings and is properly aligned, plumb, and adequately braced.	MCDocs
☐		Verify the formwork is clean and oiled as specified in PUB 408 Section 1001 to ensure its removal does not damage the new concrete. Ensure the formwork that is reused has no obvious defects.	
☐		Confirm that embedded elements are secured to formwork prior to concrete placement per PUB 408 Section 1001.	
☐		When wooden spreaders are removed, steel spacers are embedded in the concrete as required by PUB 408 Section 1001. Do not leave wood separators in the completed work.	
☐		Ensure rebar spacing and clearances are checked relative to the plans.	MCDocs
☐		For epoxy-coated rebar, ensure all areas of damage have been touched up with an approved epoxy paint per PUB 408 Section 1002.	
☐		Verify rebar splice and embedment lengths are as shown on the contract drawings.	MCDocs
☐		Confirm the concrete plant has a release for concrete delivery.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
☐		Verify whether enough cylinders have been molded for compressive strength testing in accordance with PUB 408 Section 1001 specifications.	PPCC

Section 1000: Structures

☐		Task	Reference
☐		Ensure concrete is placed in lifts not exceeding 15 inches and is properly vibrated per PUB 408 Section 1001; Ensure that concrete does not drop more than 5 feet during placement.	
☐		Verify the air temperature conforms to specifications for concrete placement in accordance with PUB 408 Section 1001.	
☐		Ensure concrete is finished per PUB 408 Section 1001.	
☐		Verify curing is placed in accordance with PUB 408 Section 1001. Water curing, spray curing, or a combination of both may be used. Flood curing is also permitted for footings if the water temperature is 40F or greater.	
☐		Ensure temperatures are verified during the curing period.	PPCC
☐		If insulating blankets are used, confirm they are properly secured.	PPCC
Abutments			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure formwork is constructed to match the contract drawings and is properly aligned, plumb, and adequately braced.	MCDocs
☐		Verify the formwork is clean and oiled as specified in PUB 408 Section 1001 to ensure its removal does not damage the new concrete. Ensure the formwork that is reused has no obvious defects.	
☐		Ensure waterproofing and waterstops are placed at abutments before approach slab placement in accordance with PUB 219M BC Standard 788M and PUB 408 Section 1001.	
☐		Verify pipes/conduits contain weep holes, structure foundation drains, or utilities.	MCDocs
☐		Ensure chamfer strips are placed at all exposed corners in accordance with PUB 408 Section 1001 unless indicated otherwise on the drawings.	
☐		Verify anchor bolts, expansion plates, and pier nosing angles are placed as indicated on the contract drawings.	MCDocs
☐		Confirm the beam seat and anchor bolt layout are in strict accordance with the contract and approved shop drawings.	MCDocs

Section 1000: Structures

☐		Task	Reference
			PPCC
☐		If dowels are used, ensure the dowel layout and embedment length are accurate.	MCDocs
☐		Verify rebar spacing and clearances are correct.	MCDocs
☐		For epoxy-coated rebar, ensure all areas of damage have been touched up with an approved epoxy paint per PUB 408 Section 1002.	
☐		Verify rebar splice and embedment lengths are as shown on the contract drawings.	MCDocs
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
☐		Verify whether enough cylinders have been molded for compressive strength testing in accordance with PUB 408 Section 1001 specifications.	PPCC
☐		Ensure concrete is placed in lifts not exceeding 15 inches and is properly vibrated per PUB 408 Section 1001; Ensure that concrete does not drop more than 5 feet during placement.	
☐		At construction joints where rebar extends through, ensure the adjacent concrete is not placed for a minimum of 24 hours per PUB 408 Section 1001.	
☐		Verify the air temperature conforms to specifications for concrete placement in accordance with PUB 408 Section 1001.	
☐		Ensure concrete is finished per PUB 408 Section 1001.	
☐		Verify curing is placed in accordance with PUB 408 Section 1001. Water curing, spray curing, or a combination of both may be used. Flood curing is also permitted for footings if the water temperature is 40F or greater.	
☐		Confirm bearing areas of substructures are finished in accordance with PUB 408 Section 1001.	
☐		Confirm thermometers are placed on the finished concrete to verify temperatures during the curing period. During cool or cold weather, preheat thermometers and verify initial high/low temperatures. If the air temperature is below 50F and/or below concrete temperatures, a false reading could occur.	PPCC

Section 1000: Structures

☐		Task	Reference
☐		If insulating blankets are used, confirm they are properly secured.	
Integral Abutments			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		In the Pile Log, document all of the necessary information (e.g., pile length and size, splice length, depth of penetration, blow counts) about the pile before, during, and after driving. See PUB 408 Section 1005.	
☐		Ensure that the abutment foundations are excavated to plan dimensions and elevations.	MCDocs
☐		Verify that the pile locations are laid out as per plan.	MCDocs
☐		Verify the pile pre-drilling to ensure holes are drilled to the required diameter and depth and if permanent casing is required.	MCDocs
☐		Ensure that the piles are set in pre-drilled holes and that the void around the piles is filled with sand or pea gravel before driving the piles. Verify the orientation of the piles.	MCDocs
☐		Verify that the deck concrete is placed before the concrete is placed in the end diaphragms except for the 4-foot portion of the deck from the front face of the abutment, which will be placed two hours after placing the concrete in the end diaphragms.	MCDocs
Piers			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure formwork is constructed to match the contract drawings and is properly aligned, plumb, and adequately braced.	MCDocs
☐		During footing construction, verify rebar projecting from the footing to the pier section is to the length specified in the bridge plans.	MCDocs
☐		Ensure the rebar is tied in place or on the ground and placed using a crane or other lifting equipment per PUB 408 Section 1002 specifications.	

Section 1000: Structures

☐		Task	Reference
☐		Verify rebar in pier columns and caps is checked, and its condition is thoroughly documented.	MCDocs
☐		Due to the visibility of piers, ensure quality formwork and good vibration techniques are performed for concrete placement in all pier sections.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
☐		Verify the air temperature conforms to specifications for concrete placement in accordance with PUB 408 Section 1001.	
☐		Ensure concrete does not freefall more than 5 feet and is placed in 15-inch maximum lifts in accordance with PUB 408 Section 1001, utilizing elephant trunks, tremies, or concrete pumps in this process.	
☐		Ensure all embedded fixtures, such as bearings, dowels, and form supports in caps and columns, are included per structure plans before concrete placement.	MCDocs
☐		Confirm the beam seat and anchor bolt layout are in strict accordance with the contract and approved shop drawings.	MCDocs
☐		If dowels are used, ensure the dowel layout and embedment length are accurate.	MCDocs
☐		Confirm liquid membrane curing compound is placed on all concrete as required by PUB 408 Section 1001, except on construction joints, which must be water cured. Other curing is used if weather conditions require.	
☐		Verify a protective concrete coating is used per PUB 408 Section 1019 and as indicated on the contract structure plans.	MCDocs

AFTER CEMENT CONCRETE SUBSTRUCTURES CHECKLIST

☐		Task	Reference
Footings			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Document information regarding the construction of the footings, such as dimensions, volume calculations, and calculated pay quantities in the FSB.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		Ensure curing temperatures of the footings are monitored closely and recorded in the eConcrete app for each day of the curing period.	eConcrete
☐		Ensure formwork is removed after a specified period and/or cylinder breaks are sufficient per PUB 408 Section 1001.	PPCC
Abutments			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document information regarding the construction of the abutments, such as dimensions, volume calculations, and calculated pay quantities in the FSB.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		Ensure curing temperatures of the abutments are monitored closely and recorded in the eConcrete app for each day of the curing period.	eConcrete
☐		After the abutment wall concrete is placed, superstructure beams cannot be erected on top of the abutment wall for a minimum of three days beyond placement and only if the concrete has obtained the required minimum strength as specified in PUB 408 Section 1001.	
☐		Ensure formwork is removed after a specified period and/or cylinder breaks are sufficient per PUB 408 Section 1001.	PPCC
☐		Verify backfill operations behind the abutment wall do not begin until seven days after placing the last concrete and only if the concrete has achieved the seven-day minimum mix design compressive strength as specified in PUB 408 Section 1001.	
Integral Abutments			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Section 1000: Structures

☐		Task	Reference
☐		Document information regarding the construction of the abutments, such as dimensions, volume calculations, and calculated pay quantities in the FSB.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		Ensure curing temperatures of the abutments are monitored closely and recorded in the eConcrete app for each day of the curing period.	eConcrete
Piers			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document information regarding the construction of the abutments, such as dimensions, volume calculations, and calculated pay quantities in the FSB.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		Ensure curing temperatures of the piers are monitored closely and recorded in the eConcrete app for each day of the curing period.	eConcrete
☐		Where formwork from previous concrete column lifts remains in place and is adequately braced, work may continue on the upper sections of the column 24 hours after the concrete placement of the lower sections per PUB 408 Section 1001.	
☐		Where formwork from previous concrete column lifts does not remain in place or supported by a previous lift, work may continue on upper sections five days after the concrete placement of the lower sections and only if the concrete attains the minimum compressive strength of the concrete per PUB 408 Section 1001.	
☐		Ensure cap forms supported by pier columns are not placed until five days after the column concrete placement and only if the required compressive strength of the column concrete is reached per PUB 408 Section 1001.	
☐		Ensure cap forms supported by the ground or the footing are not placed until 24 hours after column concrete placement per PUB 408 Section 1001.	
☐		After cap concrete placement, ensure the forms under the cap are retained for five days and then only removed if the minimum	

☐		Task	Reference
		compressive strength of the concrete is reached per PUB 408 Section 1001.	
☐		Verify that the outside faces of pier cap forms are in place for a minimum of 12 hours after completing the placement of concrete. Then, remove forms once the concrete has hardened enough to preclude damage resulting from form removal per PUB 408 Section 1001.	
☐		Verify pier formwork for concrete under cold weather cure is retained for five days and then only removed if the minimum compressive strength of the concrete is reached per PUB 408 Section 1001.	
☐		Ensure holes left in the concrete after form removal are patched with non-shrink grout.	
☐		Verify that beams may be set in three days with required concrete compressive strength after concrete placement of a solid shaft per PUB 408 Section 1001 specifications.	
☐		Verify that beams may be set in five days with required concrete compressive strength after concrete placement of a cap section per PUB 408 Section 1001 specifications.	

Material & Equipment

Footings

The concrete used in the footings (typically Class A) must meet the requirements of PUB 408 Section 704 and the contractor's approved concrete QC plan. The concrete is supplied by an approved concrete plant and mixed from an approved concrete mix design for the class indicated.

In addition to concrete, the contractor's materials include steel or wood formwork, rebar, and rebar support systems (e.g., mortar blocks, wire chairs, and plastic chairs).

The contractor uses various equipment and materials for excavation, lifting formwork/rebar, and concrete finishing. Excavation activities incorporate excavators, dump trucks, and hydraulic hammers. Cranes, aerials lifts, excavators, and other acceptable equipment are used for lifting. Concrete buckets, vibrators, finishing tools, and concrete testing equipment are used in conjunction with concrete placement.

Abutments

Materials used for abutments include steel or wood formwork, rebar, and concrete (typically Class A), as well as rebar support systems that incorporate items such as wire or plastic chairs. The concrete must be supplied by an approved concrete plant and mixed using an approved mix design for the class indicated.

The contractor uses a variety of lifting equipment, including cranes, aerial lifts, and excavators. Concrete buckets, vibrators, finishing tools, and concrete testing equipment are used in conjunction with concrete placement. Often, drawings require that abutments incorporate architectural treatment.

Integral Abutments

The material required to construct the integral abutment structure would be specified in the project documents, such as the plan drawings and contract special provisions. The piles used in the abutment would meet the requirements of the structure plans and PUB 408 Section 1005. The class of concrete required would be supplied by an approved concrete plant and would be tested by the contractor's technician before placement to ensure it meets the requirements of PUB 408.

The contractor would place reinforcement as shown on the plan drawings, which would be checked by the inspector to ensure that the reinforcement has the required size and spacing. All material would be certified by the contractor on Form CS-4171 that it meets the requirements of the applicable PUB 408 Section.

The contractor may need excavating equipment such as an excavator, backhoe, or a front end loader capable of excavating the abutment foundation to the required dimensions and elevations. A drill capable of pre-drilling holes to the size and depth required for the pile installation may be needed. The contractor would need a pile hammer capable of driving piles to the required depth. The pile hammer data would be submitted by the contractor to the department for approval before driving any piles. The contractor would need a crane of adequate size to set the required girders. The crane also might be used to place concrete with a concrete bucket. The contractor would need a deck finishing machine capable of finishing the deck concrete to the required elevation, cross slope, and texture.

The contractor and the inspection staff would need concrete testing equipment used to test the concrete that is to be placed to ensure it meets the requirements of PUB 408 specifications.

Piers

Class A concrete is used in the construction of piers. Portions of a pier above the beam seats, such as shear blocks and cheek walls, are typically constructed using Class AA cement concrete. All concrete must be supplied from an approved concrete plant and mixed using an approved mix design for the class of concrete indicated. Large quantities of rebar and concrete, as well as membrane curing compounds and protective concrete coatings, are also used for pier construction.

Cranes, aerial lifts, concrete pumps, excavators, and other lifting equipment may be used to place formwork, falsework, rebar, and concrete. Forms are made of steel or wood, and ties, spreaders, braces, bolts, chairs, and walers may be required to hold pier formwork in place. Concrete buckets, vibrators, finishing tools, and concrete testing equipment are used in conjunction with concrete placement.

Due to the height of the work, additional safety equipment, including safety harnesses, lanyards, and rebar caps, is often required. Often, the drawings require that piers incorporate architectural treatment.

Mechanical:				
Aerial Lift	Backhoe	Concrete Bucket	Concrete Mixer Truck	Concrete Pump Truck
Crane	Deck Finisher	Drill Rig	Dump Truck	Excavator
Front End Loader	Hydraulic Hammer	Pile Hammer		

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Hand Tools:				
Concrete Bullfloat	Concrete Vibrator			
Testing/Inspection:				
Concrete Testing Equipment				

Construction Methods

Footings

Prior to construction, the contractor's engineer provides the footing layout, using grade stakes showing the depth of cuts and work points. The contractor then excavates to the required elevation and, if necessary, constructs a temporary excavation support system approved by the District SCE or DGE as the excavation progresses. This system may be necessary if one or more of the following conditions exist during excavation: the depth of the excavation exceeds 4 feet, the extracted material is very unstable, or the required slope layback cannot be achieved. Refer to PUB 8 Section 1000.3 for information on temporary excavation support systems.

The contractor constructs the required footings and, if appropriate, installs piling. Reference PUB 8 Sections 1000.4, 1000.5, and 1000.7 for details on piles, caissons, and soldier pile walls. If spread footings are required, the District SCE or DGE reviews and approves the bottom of the footing elevation after excavation. If the bottom of the footing elevation is found to be of unstable material, the area is undercut as directed by the District SCE or DGE. The undercut is then backfilled with acceptable material to the bottom of the footer elevation. The contractor's engineer then lays out the footings with necessary work points, and the contractor sets the formwork using alignment, grade, and other required dimensions set by the contractor's surveyor and the contract drawings. All materials to be embedded in the concrete, including rebar, are secured to the formwork as required. In some instances, the footer concrete is poured directly against bedrock, and no forming is needed.

The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan. The contractor then places the concrete, and compressive strength cylinders are molded as specified in PUB 408 Section 704. The lifts used to place the concrete cannot exceed 15 inches, and the concrete must be vibrated as required.

When the depth of water in the foundation area is greater than 1 inch, an anti-washout admixture should be utilized in the concrete. If the admixture is waived, the contractor should add 25 percent more cement. This does not apply to drilled caissons, only spread footings per PUB 408 Section 1001.3.

Once the concrete is finished, appropriate curing is placed. Refer to PUB 8 Section 1000.9 regarding curing. Formwork is removed after a specified period, and if needed, additional curing is completed. After specified strengths in the concrete cylinder breaks are achieved, all curing is removed.

Abutments

The contractor provides the layout of the abutment wall, with necessary work points, on top of the footing, and the formwork is set to the work points according to the contract drawings. The rebar is then placed and secured.

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The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan.

The contractor places hoppers and tremie tubes or other acceptable devices within the formwork to prevent concrete from free falling more than 5 feet. Concrete is tested in accordance with the approved QC plan, and compressive-strength cylinders are molded. The concrete is placed in lifts not to exceed 15 inches and is vibrated as required. The concrete is finished on top of the abutment, as shown on the approved contract drawings. Bearing areas of substructures are finished as required by specifications.

The contractor submits as-built beam seat elevations stamped by a PLS or PE for review and acceptance by the District SCE. Do not allow beams to be set until accepted.

After concrete placement, curing is placed. More than one type of curing can be used, depending on the part of the abutment being cured. Refer to PUB 8 Section 1000.9 regarding curing. Formwork is removed after a specified period, and if needed, additional curing is completed. After specified concrete strengths are achieved, all curing is removed.

Integral Abutments

The contractor's engineer lays out the locations for the abutments, and the abutment foundations are excavated as per plan. Pile locations are laid out in the abutments, and these locations are pre-drilled to the required diameter and depth. The piles are set in the pre-drilled holes, and the space around the pile is filled with sand or pea gravel. The piles are driven to the required refusal criteria.

The contractor constructs forms for the pile cap to the plan dimensions. After the forms are constructed, reinforcement, as shown on the plan drawings, is placed. The contractor places the required class of concrete in the pile cap forms to the beam seat elevations indicated. After the concrete is cured and meets the required strength, the type of girders indicated on the plan are set in place. The contractor sets forms and places reinforcement on the deck and end diaphragms, as shown on the structure plan.

The contractor sets up a concrete deck finishing machine, and a dry run is performed to ensure the deck is the plan depth, the reinforcement has the required clearance, and the deck has the required cross slope. After the dry run has been performed and approved by the inspector, the contractor places, finishes, and cures the required class of concrete to within 4 feet of the front faces of the abutments. Concrete is placed in the end diaphragms, and after a two-hour time elapse, the concrete in the 4-foot blockout in the deck at the front face of the abutment is placed.

The wing walls are then constructed as shown on the plan, and after the deck concrete has cured and meets the required strength, the parapets are constructed as indicated on the structure plan.

Piers

The contractor submits required shop drawings for approval before construction.

After the footing is constructed, the contractor ties additional rebar to the projected footing steel for the pier column/shaft sections. Formwork is placed using alignment, grade, and other required dimensions from the structure plans set by the contractor's surveyor.

For piers with caps, falsework (per the accepted working drawings) and rebar are placed for the cap sections. Beam seats, dowels, bearings, and other embedded fixtures are accounted for in the forms before cap concrete placement. Due to the tight spacing of larger bars, some of the rebar in the top of the cap is left temporarily untied until the concrete reaches the rebar layer. This is done so that concrete can easily flow to the bottom of the cap with minimal segregation and free fall. Designers may incorporate a larger space in the cap rebar for this purpose.

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The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and approved concrete QC plan. Concrete for the column/shaft sections was placed and cured using approved methods.

Concrete is properly placed and cured in the cap sections. Once cured, a protective coating is applied to the concrete as required by the structure plans.

The contractor submits as-built beam seat elevations stamped by a PLS or PE for review and acceptance by the District SCE. Do not allow beams to be set until accepted.

Measuring & Payment Methods

Footings

Excavation is paid as part of the Class 3 excavation line item under the structure lump sum or in cubic yards.

Undercut areas will be paid for by additional Class 1 excavation in cubic yards.

Rebar is paid in pounds under a separate line item number.

Concrete is paid as part of the concrete line item under the structure lump sum or in cubic yards.

Formwork and curing are incidental to the concrete item number.

Measurements and payments for temporary excavation support, piles, and drilled caissons are made under an individual line item number.

Abutments

Concrete is paid as part of the concrete line item under the structure lump sum or by the cubic yard.

Rebar may be measured and paid per pound or as part of a lump sum.

Protective coatings for concrete surfaces may be paid in square yards or as part of the lump sum.

Formwork and curing are incidental to the concrete item number.

Integral Abutments

The structure is paid as a lump sum. Percentages of the lump sum are paid on a PSA as the structure work is completed.

Piers

Most of the pier construction is paid as part of the bridge lump sum.

Rebar may be measured and paid per pound or as part of a lump sum.

Protective coatings for concrete surfaces may be paid in square yards or as part of the lump sum.

Formwork and curing are incidental to the concrete item number.

14. CEMENT CONCRETE SUPERSTRUCTURES (SEC. 1001)

This section addresses elements common to the construction of most concrete structures. These elements include the placement of bridge decks, bridge parapets, and concrete beams. The following sections outline the general considerations and requirements associated with each of these elements:

Placement of Concrete Beams

This section addresses the placement of concrete beams for bridge superstructures. In general, there are three types of concrete beams: I-beams, spread box beams, and adjacent box beams.

- **I-beams** are I-shaped beams that are usually used for larger spans.
- **Spread box beams** are square or rectangular-shaped beams used for smaller spans.
- **Adjacent box beams** are similar to spread box beams, except they are placed adjacent to one another and tend to be less deep than either I-beams or spread box beams. Adjacent box beams are used when the overall superstructure is required to be smaller due to vertical clearance restrictions.

Bridge Decks

This section addresses the construction of concrete bridge decks and diaphragms, including falsework, SIP forms, and placing, finishing, and curing of the concrete bridge decks and diaphragms.

Bridge Parapets

This section addresses the construction of bridge parapets, including falsework, and placing, finishing, and curing of the concrete bridge parapets. Slip form parapets are a commonly used method of extruding concrete without the use of forms.

☐ Review

 Documentation Required

BEFORE CEMENT CONCRETE SUPERSTRUCTURES CHECKLIST

☐ 	Task	Reference
Placement of Concrete Beams		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch applicable safety harness training videos.	Construction Training Videos
☐	Confirm there are approved shop drawings showing beam detail and dimensions.	PPCC
☐	Ensure there is an approved erecting plan detailing erecting procedures as well as crane requirements.	PPCC

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☐ 	Task	Reference
☐	Verify there is a submitted and approved plan for a fall protection system.	PPCC
☐	Confirm beams are stored in the upright position and are supported by skid plates similar to their final positioning on the bearing pads on the approved shop drawings.	
☐ 	Ensure the location and concrete finish of the bearing/beam seat is checked prior to bearing and beam placement. Ensure the beam seat elevations have been surveyed by the contractor and submitted/accepted by the department as required by PUB 408 Section 1001.	
☐	Adjacent Box Beams: Ensure shear key widths are checked before the placement of adjacent box beams per PUB 219M BC Standard 775M.	
☐	Adjacent Box Beams: Prior to beam setting, verify the shear keys are cleaned by sandblasting, water blasting, brushing, or other approved methods required by PUB 219M BC Standard 775M.	
Bridge Decks		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch applicable training videos for bridge deck pre-placement operations, bridge deck testing placement and pumping, and Bridge Deck Finishing.	Construction Training Videos
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Verify deck placement follows the pour sequence as defined on the contract drawings or approved by the Department.	MCDocs
☐	Ensure utility conduit encased in the bridge deck and/or parapet concrete has expansion fittings at the bridge expansion joints in accordance with PUB 219M BC Standard 721M.	
☐ 	Confirm the dimension of the utility expansion fitting set during placement corresponds to the setting shown on the approved shop drawing for the ambient air temperature and is in accordance with PUB 219M BC Standard 721M.	PPCC
☐ 	Ensure that contractor-submitted and approved plans for deck overhang formwork are followed when building deck overhangs. Overhang formwork designs should account for the weight of the	PPCC

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□		Task	Reference
		deck finishing and curing equipment, as well as the normal concrete and rebar load.	
□		Verify forms account for camber and deflection when concrete is placed.	PPCC
□		Confirm forms provide a neat, clean surface for concrete placement due to the visibility of the concrete after form removal per PUB 408 Section 1001.	
□		Ensure formwork between beams is either SIP steel or removable wood forms per PUB 219M BC Standard 732M.	
□		Verify SIP deck forms and included hardware have certifications, are free from damage, and are per approved shop drawings and PUB 219M BC Standard 732M. Attention should be given to connection methods of SIP forms in negative moment regions, typically near piers, on steel primary support members, as welding is typically not approved.	ECMS MCDocs PPCC
□		Confirm an approved QC and deck concrete placement plan is obtained and planned procedures are per deck placement sequences as required by the structure plans.	MCDocs PPCC
□		Ensure weather conditions and forecasts are within the requirements of PUB 408 Sections 501 and 1001 for concrete placement.	
□		Verify a dry run of the finishing machine, including measuring and recording top rebar clearances, concrete depths, and out-to-out (deck width) measurements at the specified locations as required by PUB 2 Part C.10, is performed and approved by the engineer. After the deck finishing machine is at the correct cross slope and a successful dry run has been completed, the deck machine and rails can no longer be adjusted without the consent of the engineer.	
□		During the dry run, confirm the contractor's fogging equipment is fully operational as required by PUB 408 Section 1001. Fogging equipment prevents concrete drying at the surface and is used when the evaporation rate is exceeded.	
Bridge Parapets			
□		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
□		Verify that concrete QC plan, mix design, and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs

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☐		Task	Reference
☐		Verify deck concrete meets time and strength requirements, per PUB 408 Section 1001, before parapet concrete is placed.	
☐		Slip Form Parapets: For Representative approval, a 50-foot slip form parapet test strip is constructed using the identical method used for the actual parapets. The test strip may be the actual bridge parapet if the engineer approves. If the first test strip is not acceptable to the engineer, modifications are made, and a second test strip is made, as required. If the contractor or the engineer does not find the test strip results acceptable, fixed-form parapets may need to be used. See PUB 408 Section 1001.	
☐		Slip Form Parapets: Ensure concrete cores are taken from the test section and sent to the Bureau of Construction and Materials as required by PUB 408 Section 1001.	
☐		Slip Form Parapets: Verify rebar clearance (cover) in the test section is checked using a pachometer per PUB 408 Section 1001.	
☐		Slip Form Parapets: Prior to concrete placement, ensure a dry run of the slip form machine is performed and documented to check the clearances of rebar and other fixtures in the parapet as required by PUB 408 Section 1001.	
☐		Slip Form Parapets: Verify rebar and bulkheads are braced, as required by PUB 408 Section 1001, to withstand the force of the slip form concrete placement.	
☐		Slip Form Parapets: Confirm saw cut joints are marked prior to concrete placement so that the rebar is avoided when the saw cuts are made, as required by PUB 408 Section 1001.	

DURING CEMENT CONCRETE SUPERSTRUCTURES CHECKLIST

☐		Task	Reference
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
Placement of Concrete Beams			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure that approved beam shop drawings and erection plans are strictly followed.	PPCC

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☐		Task	Reference
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Upon delivery, verify beams are checked for a plant inspector's stamp and items such as dimensions and camber.	MCDocs
☐		Confirm beams are checked for damage, twisting, and cracking that may result from delivery and construction activities. Damaged beams may need to be replaced, as determined by the District SCE.	
☐		Ensure beams are lifted using the manufacturer-provided lifting eyes located at the end of the beams. A pre-stressed beam is never lifted at the middle section of the beam.	PPCC
☐		Confirm crane location, size, picking, and setting procedures strictly adhere to the approved erection plans.	PPCC
☐		Ensure skid beams, if applicable, are of the type and size required by the approved erection plans.	PPCC
☐		After the beam is set on the bearing, ensure it is checked for proper overhang on the rear, left, and right sides of the bearing.	MCDocs
☐		When neoprene bearing pads are used, verify the bearing of the beam on the pad is checked for gaps and corrected per PUB 408 Section 1080.	
☐		Confirm an approved non-shrink mortar is used for gap repair in accordance with PUB 408 Section 1080.	
☐		Ensure mortar is placed between the bearing seat and the bearing pad only after the initial beam set, and no other corrective action can be used per PUB 408 Section 1080.	
☐		Verify beams are checked as they are placed for proper spacing.	MCDocs
☐		Confirm beams are supported after placement according to submitted and approved beam bracing plans, shop drawings, and PUB 219M BC Standard 772M, which is particularly important for large I-beams.	PPCC
☐		Ensure a submitted and approved fall protection system is placed on the beams before construction activity begins.	PPCC
☐		Verify, if required per the accepted erection plan, temporary tie-downs may be required after beams have been set. Additionally, sequencing of the connection of diaphragms may be required if steel diaphragms are used.	PPCC

☐		Task	Reference
☐		Adjacent Box Beam: Verify longitudinal joints are filled with non-shrink mortar and properly cured per PUB 219M BC Standard 775M. After the mortar is placed, construction activity on the beams is halted for 24 hours.	
Concrete Diaphragms			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure formwork was constructed to match the contract drawings and is properly aligned, plumb, and adequately braced.	
☐		Verify that the rebar layout, size, spacing, quantity, and clearances are correct.	
☐		Ensure the dowel layout and embedment length are accurate.	
☐		Confirm isolation/expansion material is placed as required.	
Bridge Decks			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing
☐		Ensure overhang forms contain drip and v-notches as indicated by the structure plans.	MCDocs
☐		Verify deck pan support angles along the top flange of the beams are not welded to the beam in tension areas as defined on the approved contract and shop drawings (for steel beams only).	PPCC
☐		Confirm SIP forms are cut using saws, shears, and similar tools in the field but are not cut by burning per PUB 408 Section 1001.	
☐		Verify damage to SIP coatings, except weld burns, is repaired with approved methods specified in PUB 408 Section 1001.	
☐		Ensure formwork was constructed to match the contract drawings and is properly aligned, plumb, and adequately braced.	MCDocs
☐		Verify that the rebar layout, size, spacing, quantity, and clearances are correct.	MCDocs

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☐		Task	Reference
☐		Confirm rebar passing from the deck into the parapet is in the proper location before deck concrete placement.	MCDocs
☐		Ensure particular attention is given to negative moment regions (over the piers) where rebar patterns change. Often, it is difficult to maintain spacing and clearance in these areas. Splices in these areas are important and must be placed accurately.	MCDocs
☐		Verify the positioning of the rebar chairs is maintained as required by PUB 408 Section 1001.	
☐		Confirm tie wire is used to secure the top rebar mat to the bottom rebar mat as required to prevent floating or movement during concrete placement per PUB 408 Section 1001.	
☐		Ensure rebar is placed per plans, is free from damage, frost, dirt, and debris, and is tied in accordance with PUB 408 Section 1001 before concrete is ordered.	
☐		Verify rebar damaged during construction is repaired with an approved material or replaced per PUB 408 Section 1002.	
☐		Confirm materials, such as beam composite bars, lifting eyes, diaphragm bars, and dowels, are coated.	
☐		Ensure all formwork and rebar are checked per structure plans.	MCDocs
☐		Verify burlap is soaked in water tanks 48 hours in advance to ensure a saturated condition per PUB 408 Section 1001.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
☐		Ensure expansion dam openings are set properly, as required by PUB 408 Section 1001, for current weather conditions.	
☐		Verify bulkhead material is ready in case operations are stopped unexpectedly for extended periods per PUB 408 Section 1001.	
☐		Confirm scuppers are set and secured to the proper grade before deck concrete placement. Determine final scupper elevations by monitoring grinding and/or overlay placement per PUB 219M BC Standard 751M.	
☐		Ensure scuppers and expansion dam openings are covered during deck placement to keep them from filling with concrete.	

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☐		Task	Reference
☐		Verify concrete is placed in a continuous operation, in accordance with PUB 408 Section 1001, so the finishing machine will not bulldoze the concrete.	
☐		Confirm the rate of concrete placement meets a minimum of 20 linear feet per hour as required by PUB 408 Section 1001.	
☐		Ensure concrete is discharged in accordance with PUB 408 Section 1001 so that it prevents excessive loads on the formwork.	
☐		Verify concrete is carefully and properly vibrated before being finished by the finishing machine as required by PUB 408 Section 1001.	
☐		After the concrete is vibrated, ensure no walking or disturbing rebar extending into the parapet area is permitted.	
☐		Verify that placed concrete is checked for depth and top mat rebar clearance per PUB 2 Part C.10, and results are recorded and compared with the dry run depths.	
☐		After finishing, confirm the concrete is checked with a 12-foot straight edge for irregularities per PUB 408 Section 1001. High areas are cut and refinished, while low areas are filled, reconsolidated, and refinished. A smart level is used to confirm proper cross slope at the shoulder where the contractor is hand finishing along the gutter line.	
☐		Consider what method will be used to provide texture to the finished deck. To achieve the desired texture, use a tine rake with tine spacing per PUB 408 Section 501 to tine the finished concrete. Alternatively, decks may be mechanically textured by sawcutting grooves into the concrete after curing. See PUB 408 Section 1001.	
☐		Ensure, if tining, an intermediate monomolecular film (confilm) curing agent is applied immediately after raking the deck surface. Additional coats are applied as needed to prevent the surface from drying before wet burlap is applied per PUB 408 Section 1001 specifications. The curing agent is not used to aid in finishing the concrete. This step is not required if the deck will be mechanically textured.	
Bridge Parapets			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Collect truck delivery tickets for materials.	eTicketing

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□		Task	Reference
□		Ensure placement sequencing of the parapet is the same as the bridge deck placement or in the sequence approved by the District SCE.	MCDocs
□		Verify that the utility conduit encased in the bridge deck and/or parapet concrete has expansion fittings at the bridge expansion joints per PUB 219M BC Standard 721M.	
□		Confirm the dimension of the utility expansion fitting set during placement corresponds to the setting shown on the approved shop drawing and PUB 219M BC Standard 721M for the ambient air temperature.	PPCC
□		Ensure an approved concrete bonding compound is used between new and existing concrete when specified per PUB 408 Section 1001.	
□		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
□		Ensure weather conditions and forecasts are within the requirements of PUB 408 Section 1001.	
□		Verify all placement, consolidation, finishing, and curing equipment is ready for use prior to concrete delivery.	
□		Confirm vibrators, as specified in PUB 408 Section 1001, are used for concrete consolidation. Their use is important to the visual and structural results of concrete placement.	
□		Ensure concrete is properly cured using membrane spray cure, wet burlap, heat, or other method as required by PUB 408 Section 1001 specifications. Membrane spray cure is not used if the concrete is treated with protective coatings, such as linseed oil or penetrating sealer.	
□		Maintain proper curing temperatures, per PUB 408 Section 1001, due to the small dimensions of a parapet.	
□		Fixed Form Parapets: Ensure parapet forms are clean, oiled, tight-fitting, undamaged, and in good condition prior to concrete placement, as specified in PUB 408 Section 1001.	
□		Fixed Form Parapets: Verify chamfer strips, v-notches, joints, rebar, and other embedded materials are in place and checked prior to concrete placement per PUB 408 Section 1001.	

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☐		Task	Reference
☐		Fixed Form Parapets: Confirm concrete is placed in lifts as specified in PUB 408 Section 1001.	
☐		Fixed Form Parapets: Ensure forms are checked with a 12-foot straight edge on the front, top, and rear for loss of dimension and shape before, during, and after concrete placement, and corrective action is taken as necessary.	
☐		Slip Form Parapets: Verify concrete defects are repaired per the Representative's approval, and defects such as honeycombing, sags, and tears that cannot be repaired without water or extra concrete are rejected per PUB 408 Section 1001.	
☐		Slip Form Parapets: Ensure the only traffic allowed on the bridge during slip forming is the slip form machine and the concrete delivery truck, as specified in PUB 408 Section 1001.	
☐		Slip Form Parapets: Confirm slip form concrete is vertically brush finished per PUB 408 Section 1001.	
☐		Slip Form Parapets: Ensure there is no tearing, slumping, or loss of shape to freshly placed slip form concrete per PUB 408 Section 1001.	

AFTER CEMENT CONCRETE SUPERSTRUCTURES CHECKLIST

☐		Task	Reference
Placement of Concrete Beams			
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		After beam placement is complete, verify waterproofing is applied as required by the structure plans.	MCDocs
☐		Adjacent Box Beams: After grouting shear keys, do not allow traffic on a span until grout compressive strength is 3,200 pounds per square inch minimum, as indicated in PUB 408 Section 1080.	
☐		Adjacent Box Beams: If an asphalt surface course is placed, a coal tar protective coating is applied to beams and shear keys, if required, per PUB 408 Section 1080.	
Bridge Decks			

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☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document information regarding the construction of the bridge deck, such as dimensions, volume calculations, and calculated pay quantities in the FSB.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		After intermediate curing is placed (if required as noted above), ensure the deck is water-cured for 14 days and as long as required to attain minimum compressive strengths (determined from concrete cylinder testing). Two layers of overlapping wet burlap with a wetting system (weeper hoses, sprinklers, etc.) are used in this process. The deck is covered with white polyethylene sheeting for seven days after the initial 14-day water cure. See PUB 408 Section 1001.	
☐		Ensure curing temperatures of the deck are monitored closely and recorded in the eConcrete app for each day of the curing period.	eConcrete
☐		Verify preparations (e.g., blankets, hay, heaters) for cool and cold weather curing are made. Low-temperature readings, as indicated in PUB 408 Section 1001, may cause extended curing time. In severe cases, concrete may need to be removed.	
☐		Confirm only double layers of wet burlap are used, as membrane curing is not permitted for bridge decks.	
☐		Ensure formwork is removed after the specified time and the concrete strength requirements are met as indicated in PUB 408 Section 1001.	
☐		Ensure parapets are not constructed until seven days have elapsed since deck concrete placement and only if the concrete has reached the required strength as indicated in PUB 408 Section 1001.	
☐		Prohibit traffic on the bridge until authorized and only after 21 days and when the minimum required compressive strength is reached, as indicated in PUB 408 Section 1001.	
☐		Refer to Tables B and C in PUB 408 Section 1001 for additional external loading information.	
☐		Confirm a concrete sealer is applied after the 21-day waiting period or as required.	
Bridge Parapets			

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document information regarding the construction of the bridge deck, such as dimensions, volume calculations, and calculated pay quantities in the FSB.	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		Verify holes that are left in the concrete after formwork ties are patched with an approved non-shrink grout.	
☐		Ensure construction traffic and speed on the bridge after parapet concrete placement is regulated in accordance with PUB 408 Section 1001.	
☐		Confirm parapets rejected due to defects are replaced at no additional cost to the Department per PUB 408 Section 1001.	

Material & Equipment

Placement of Concrete Beams

Pre-stressed concrete beams should arrive on the project stamped by the plant inspector, constructed as per the approved shop drawings, and stored similar to their final configuration on the bridge seats.

The contractor uses equipment such as cranes and skid beams to place the concrete beams. Cranes are used as required by the approved erection plans; skid beams are used for more difficult placements.

Non-shrink mortar should be used for filling bearing pad gaps and shear keys.

Bridge Decks

Class AAAP cement concrete is used for bridge decks. The concrete must be supplied by an approved concrete plant and mixed using an approved mix design for the class indicated.

Special additives are often used to control the concrete set time to allow for finishing. Intermediate cure (when tining the deck only), burlap, curing compound, weeper hoses, and sprinklers are common materials used for deck curing. Polyethylene sheeting, concrete blankets, and heaters are common materials used for cool and cold weather deck curing. Formwork may be constructed of wood or steel.

Concrete equipment, including pumps, buckets, and conveyors, is required to place concrete. Concrete vibrators are important for acceptable concrete deck construction. Equipment for testing the concrete is used as required.

For finishing concrete, the contractor uses deck finishing machines, vibrating screeds when approved in writing by the District Executive (DE), floats, trowels, and tining tools. The use of steel

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trowels and fresno floats is prohibited. Decks will either be manually tined or mechanically textured according to the contract structure plan.

Bridge Parapets

Class AA concrete is used for parapets. The concrete must meet the requirements of PUB 408 Section 704 and the approved concrete QC plan. The concrete must be supplied by an approved concrete plant and mixed from an approved mix design for the class indicated. Formwork is composed of steel or wood.

Slip forming requires the use of a slip form machine. Concrete vibrators contained in the slip form machine or hand-held types and concrete testing equipment are important in acceptable parapet construction.

Mechanical:				
Concrete Bucket	Concrete Conveyor	Concrete Pump Truck	Crane	Deck Finisher
Skid Beam	Slip Form Machine	Vibrating Screed		
Hand Tools:				
Concrete Bullfloat	Concrete Rake	Concrete Tine Rake	Concrete Vibrator	
Testing/Inspection:				
12-foot Straight Edge	Concrete Testing Equipment	Smart Level		

Construction Methods

Placement of Concrete Beams

Beams are placed on the beam seat bearing by a crane. The contractor checks for gaps between the neoprene pad and the beam and, if necessary, lifts the beam, fills the gaps with non-shrink mortar as specified in PUB 408 Section 1080, and resets the beam. An approved fall protection system is then placed on the beams.

Adjacent Box Beams: Shear keys are cleaned prior to setting the beams. After the beams are set, longitudinal joints are filled with mortar and cured. Post-tensioning strands are placed laterally through fabricated sleeves in the beams and post-tensioned together as specified in PUB 219M BC Standard 775M. If an asphalt surface is to be used, a protective tar coating is then applied to the top of the beams.

Skid Beam: The contractor may use a skid beam for beam picks that are too far or too heavy for cranes to handle alone. A skid beam is a lighter beam that, unlike conventional concrete beams, can be picked at various locations on the beam to allow erecting cranes to set the skid beam on near or far beam seats.

Once the skid beam is in place, the end of the beam that will sit on the far beam seat is removed from the rear carrier and placed on the skid beam; the other end of the beam remains on the carrier of the delivery truck. A near-side crane, which is on the same side as the delivery truck,

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guides the intended far side of the beam as the delivery truck backs toward the bridge, sliding the beam on the skid beam toward the far beam seat.

When the far end of the beam is guided near enough for safe picking on the far side, a second crane picks the far end of the beam. The near crane is then used to pick the near side of the beam from the delivery truck. At this point, the beam is then set using conventional methods.

Bridge Decks

A pre-deck placement meeting is held at least two weeks before the deck placement to ensure that all parties involved understand how the placement is to be performed and to ensure that the contractor, inspection staff, and the concrete supplier are prepared for placement.

Concrete decks are placed in a specific sequence shown on the contract structure plans. Control of grades and beam camber must always be considered when placing bridge decks.

After the beams are set into position, the contractor's surveyor lays out the required points for deck formwork. Overhang forms are built and supported per the contractor's approved overhang designs. After the overhang falsework is installed, the contractor must receive certification from a professional, state-registered engineer that the falsework system is assembled as shown on the signed and sealed falsework drawings.

Deck pans (also known as SIP forms) or removable wooden forms are placed between the beams per approved shop drawings (deck grade cuts and fills from contractor survey) and checked by a Department Representative. Deck rebar and other embedded fixtures in the deck are then placed per plans.

The deck finishing machine is placed on rails usually attached to the overhang formwork. When using deck pans, the deck machine must run in the same direction as the laps of the deck pans. Deck machine rails and cross slopes are adjusted as required to attain acceptable concrete finishing depths and verified with a dry run of the deck finishing machine over the entire deck as outlined in PUB 2 Part C.10.

The contractor's PennDOT-certified technician tests the concrete in accordance with the specifications and the approved concrete QC plan. The concrete is placed with a pump, bucket, conveyor, or other device and consolidated as required with a concrete vibrator. A finishing machine is used to finish the concrete to the correct depth and cross slope. Depths are checked periodically during placement as outlined in PUB 2 Part C.10. Workers, using trowels, floats, and tining rakes, will give the deck its final finish.

Materials, such as wet burlap and weeper hoses, are placed for curing. During cool or cold weather, insulated blankets, straw, and/or heaters may be used to maintain the minimum curing temperature. After a required duration per specification, a protective concrete sealer is applied.

Bridge Parapet

Fixed Form Parapets: Prior to formwork placement, rebar must be in place according to structure plans and PUB 408 Section 1001 requirements.

Formwork is placed using the alignment, grade, and other required dimensions set by the contractor's surveyor from the structure plans. All materials to be embedded in the concrete, such as guide rail connections and noise wall attachments, are secured to the formwork as required.

The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan. Concrete is placed in lifts and consolidated with a concrete vibrator. After the concrete is placed, the formwork is removed according to the specifications. Lastly, the concrete is patched as required, and proper curing is performed.

Slip Form Parapets: Initially, a test section for the engineer's approval is placed.

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Prior to slip-forming operations, rebar must be in place according to structure plans and PUB 408 Section 1001 requirements.

The contractor may place bulkheads in the parapet to create starting and ending points for the slip-form concrete placement. The contractor then sets the alignment of the slip form machine and performs a dry run to check rebar clearances and proper parapet size, location, and other placement considerations.

The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and approved concrete QC plan. After an approved dry run, concrete supply trucks feed concrete to the slip form machine, which will place and consolidate the parapet concrete. After the concrete is extruded, it is repaired as required by the engineer and finished with vertical brushing. Lastly, curing is performed as required.

Measuring & Payment Methods

Bridge Decks

Concrete for decks is paid as part of the lump sum bridge structure or by the cubic yard.

Rebar is paid in pounds or as part of the bridge lump sum.

Bridge Parapets

Concrete for parapets is paid as part of the lump sum bridge structure or as a cubic yard item.

Rebar is paid in pounds or as part of the lump sum bridge item.

Placement of Concrete Beams

Concrete beams are paid as part of the lump sum bridge payment.

15. REINFORCED CONCRETE RETAINING WALLS (SEC. 1001)

This section addresses the construction of reinforced concrete retaining walls. These walls are similar to abutment walls, using mass and cantilevered forces to retain backfill material to varying heights for construction on or near the wall.

☐ Review  Documentation Required

BEFORE REINFORCED CONCRETE RETAINING WALLS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐ 	Ensure construction of walls does not begin until 12 hours after footings are placed, as indicated in PUB 408 Section 1001. If the footing is on piles, 48 hours must elapse before construction begins.	
☐ 	Prior to construction commencing, if required, ensure PennDOT-approved formwork shop/working drawings are obtained. Upon completion of formwork, ensure written acceptance is obtained from the contractor's engineer, and a copy is placed in the job files before the concrete placement.	PPCC
☐	Ensure rebar mark, size, type, quantity, length, and bending configuration are verified and documented as required.	MCDocs
☐	Ensure rebar spacing and clearances are checked relative to the plans.	MCDocs
☐	For epoxy-coated rebar, ensure all areas of damage have been touched up with an approved epoxy paint per PUB 408 Section 1002.	
☐ 	Verify rebar splice and embedment lengths are as shown on the contract drawings.	MCDocs

DURING REINFORCED CONCRETE RETAINING WALLS CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure formwork is constructed to match the contract drawings and is properly aligned, plumb, and adequately braced.	MCDocs
☐		Verify formwork is clean and oiled as specified in PUB 408 Section 1001 to ensure its removal does not damage the new concrete; ensure formwork that is reused has no obvious defects.	
☐		Due to the visibility of retaining wall faces, ensure quality formwork and good vibration techniques are performed for concrete placement in all wall sections.	
☐		Verify water stops at joints are placed according to PUB 219M BC Standard 735M.	
☐		Ensure pipes/conduits for weep holes, structure foundation drains, or utilities are accurately placed.	MCDocs
☐		Ensure chamfer strips are placed at all exposed corners in accordance with PUB 408 Section 1001 unless indicated otherwise on the drawings.	
☐		Verify anchor bolts and expansion plates are placed as indicated on the contract drawings.	MCDocs
☐		Confirm architectural treatment, if applicable, and any embedded elements are incorporated into the formwork as required.	MCDocs PPCC
☐		Verify concrete air meters are calibrated biweekly per PUB 408 Section 704 and documented in the eConcrete app.	eConcrete
☐		Confirm the concrete plant has a release for concrete delivery.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
☐		Verify whether enough cylinders have been molded for compressive strength testing in accordance with PUB 408 Section 1001 specifications.	
☐		Ensure concrete is placed in lifts not exceeding 15 inches and is properly vibrated per PUB 408 Section 1001.	

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☐		Task	Reference
☐		Ensure that concrete does not drop more than 5 feet during placement.	
☐		At construction joints where rebar extends through, ensure the adjacent concrete is not placed for a minimum of 24 hours per PUB 408 Section 1001.	
☐		Verify the air temperature conforms to specifications for concrete placement in accordance with PUB 408 Section 1001.	
☐		Ensure concrete is finished per PUB 408 Section 1001.	
☐		Confirm all curing materials (e.g., wet burlap, blankets, heat) are ready before concrete placement per PUB 408 Section 1001.	
☐		Verify curing is placed in accordance with PUB 408 Section 1001 immediately after the concrete is finished. Water curing, spray curing, or a combination of both may be used.	
☐		Confirm thermometers are placed on the finished concrete to verify temperatures during the curing period.	PPCC
☐		If insulating blankets are used, confirm they are properly secured.	PPCC

AFTER REINFORCED CONCRETE RETAINING WALLS CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐		Ensure formwork is removed after a specified period and/or cylinder breaks are sufficient per PUB 408 Section 1001.	PPCC
☐		Verify holes that are left in the concrete after formwork ties are patched with an approved non-shrink grout.	
☐		Ensure backfill operations behind the retaining walls do not begin until seven days after placing the last concrete and only if the concrete has achieved the seven-day minimum mix design compressive strength as specified in PUB 408 Section 1001.	

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☐ 	Task	Reference
☐ 	Confirm protective concrete coatings are placed as required by PUB 408 Section 1019 and the contract drawings.	

Material & Equipment

Material for the work includes steel or wood formwork, rebar, and concrete (typically Class A). Ties, spreaders, braces, bolts, chairs, and walers may be required to hold the formwork and rebar in place.

In constructing the retaining walls, the contractor uses lifting equipment, including cranes, aerial lifts, excavators, and other acceptable equipment. For placing concrete, concrete buckets, concrete vibrators, concrete pump trucks, concrete testing equipment, and finishing tools are used. In addition, concrete curing and protective material are required. Often, drawings require that retaining walls incorporate architectural treatment.

Mechanical:				
Aerial Lift	Concrete Bucket	Concrete Pump Truck	Crane	Excavator
Hand Tools:				
Concrete Bullfloat	Concrete Vibrator			
Testing/Inspection:				
Concrete Testing Equipment				

Construction Methods

After the footing is constructed, the contractor's engineer provides the layout of the wall on top of the footing with necessary work points. The contractor then sets the formwork to the work points per the contract drawings.

The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan. After the rebar is set and secured in the proper locations, the contractor places the concrete in the wall formwork in accordance with the approved QC plan. Compressive-strength cylinders are molded.

Following the concrete placement, the concrete is cured. More than one type of curing can be used, depending on the part of the wall cured. Formwork may be removed after a specified time. If needed, additional curing is placed after formwork removal. After achieving specified minimum strengths in the concrete cylinder breaks, all curing is removed.

Architectural treatment and protective coatings may be used as required by the plans or contract special provisions during wall construction.

Measuring & Payment Methods

Rebar is paid in pounds as a separate item number or as part of a lump sum.

Concrete is paid by the cubic yard or as a lump sum item.

Formwork is incidental to the concrete placed in the forms. The Department will not make a deduction in measurement for anchor bolts, expansion plates, drainage openings, weep holes, pipes, or conduits if the volume displaced by an installation of opening does not exceed $\frac{1}{2}$ -cubic yard.

Protective coatings and architectural treatments may be paid by the square yards or as part of the lump sum.

16. REINFORCED CONCRETE BOX CULVERTS (SEC. 1001)

This section addresses the placement of pre-cast and CIP reinforced concrete box culverts.

Pre-Cast Reinforced Concrete Box Culverts

Pre-cast reinforced concrete box culverts are prefabricated box shaped configurations used for transportation infrastructure, stormwater management, and multiple other applications.

Cast-in-Place (CIP) Reinforced Concrete Box Culverts

CIP reinforced concrete box culverts are box culverts that are made of reinforced concrete and fabricated in the field.

☐ Review  Documentation Required

BEFORE REINFORCED CONCRETE BOX CULVERTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch applicable training videos for box culverts.	Construction Training Videos
☐	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Ensure approved shop drawings are received prior to culvert construction.	PPCC
☐	Prior to construction commencing, if required, ensure PennDOT-approved formwork shop/working drawings are obtained. Upon completion of formwork, ensure written acceptance is obtained from the contractor's engineer, and a copy is placed in the job files before the concrete placement.	PPCC
☐ 	Confirm unsuitable foundation material or rock is removed to the required depth per PUB 408 Section 1001 and the District SCE or DGE.	
☐	Verify end support blocks and other elements required under the culvert are placed prior to culvert placement.	MCDocs
☐ 	Notify the appropriate environmental agencies (e.g., Fish and Boat Commission and Department of Environmental Protection (DEP)) before constructing a box culvert that could potentially impact a waterway.	

☐ 	Task	Reference
☐	Ensure all stored pre-cast concrete box culvert sections are protected from damage.	

DURING REINFORCED CONCRETE BOX CULVERTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure plan-specified bedding and backfill material are used.	
☐ 	Confirm compaction reports are performed on all bedding and backfill material in accordance with PUB 408 Section 206 .	
☐	Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐ 	Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan so test results are within specified limits.	eConcrete MCDocs
☐	Verify proper placement and curing procedures are followed for all concrete placements per PUB 408 Section 1001.	
☐ 	Ensure weather conditions and forecasts are within the requirements of PUB 408 Section 1001.	
☐	Verify rebar and formwork are checked for proper dimensions and clearances.	MCDocs
☐	Ensure an approved concrete bonding compound is used to bond the box culvert to the wing and end walls per PUB 408 Section 1001.	
☐	Prior to backfilling, verify waterproofing and protective coatings are applied, if required, per plans.	MCDocs
☐	Confirm all voids, including hand holes, pockets, lifting lugs, and tie rods, are grouted before backfilling.	
☐ 	Ensure symmetric loading is maintained when placing backfill material on each sidewall of the box culvert as required by PUB 408 Section 1001.	
☐	Verify that vibratory rollers are not used to compact backfill on or directly adjacent to the box culvert in accordance with PUB 408 Section 1085.	

☐		Task	Reference
☐		Confirm construction traffic over the box culvert is restricted in accordance with PUB 408 Section 1085.	
Pre-cast Box Culverts			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify that pre-cast box segments are delivered with certifications and contain a stamp from the inspector at the fabrication shop. Review the accepted erection plan and site constraints to ensure delivery, rigging, and setting of pre-cast elements are feasible.	ECMS
☐		Ensure dimensions are verified per PUB 408 Section 1085 and each box section is checked for damages that may be the result of delivery or construction activities. Ensure damaged sections are replaced or repaired, if necessary.	
☐		Ensure careful placement of box sections and bedding to minimize damage to the bedding and pre-cast sections.	
☐		Verify lifting equipment is capable of handling the heavy concrete box sections and that only components specified in the accepted erection plan are used.	PPCC
☐		Confirm that post-tensioning is performed on the pre-cast sections as required by the shop drawings and plans.	MCDocs PPCC
Cast-in-Place (CIP) Box Culverts			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure concrete for the base slab is placed with keyed horizontal construction joints at a short distance up each sidewall.	MCDocs
☐		Verify sidewall concrete is placed to the top slab and halted.	
☐		Ensure sidewall concrete is given sufficient time to settle (e.g., two hours per PUB 408 Section 1085) before placing the top slab concrete.	

AFTER REINFORCED CONCRETE BOX CULVERTS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Document in the eConcrete app all concrete testing that was performed, all concrete placed, and batcher mixer slips and concrete delivery tickets that were received.	eConcrete
☐ 	Record information regarding rebar placement for CIP box culverts.	
☐ 	Obtain compaction or density testing reports on all backfill.	

Material & Equipment

Material for the work may include pre-cast concrete box sections, which should arrive stamped with approved shop drawings. If CIP box culverts are specified, the concrete used must be supplied from an approved concrete batch plant and mixed using an approved mix design for the class indicated.

Post-tensioning equipment and hardware may be required for pre-cast culverts, while concrete, rebar, formwork, and concrete testing equipment are necessary for CIP culverts. Bracing, ties, and walers are used to secure formwork for CIP culverts.

Specified bedding and backfill material with requisite compaction equipment is required in placing both pre-cast and CIP box culverts. In addition, the contractor must use lifting equipment capable of lifting culvert sections without causing damage to bedding material or box sections.

Mechanical:				
Come Along	Crane	Rigging Equipment		
Hand Tools:				
Pry Bar				
Testing/Inspection:				
Post Tensioning Equipment				

Construction Methods**Pre-Cast Reinforced Concrete Box Culverts**

The contractor excavates the area to the required depth and removes unsuitable material or rock under the box sections. The approved bedding material is then placed and compacted, and end

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support blocks or other required elements under the culvert are seated. The contractor then places and post-tensions the pre-cast box sections according to the approved shop drawings.

Once the box sections are placed, the contractor places the wing walls, end walls, and associated structures. Voids, such as hand holes and lifting lugs, are grouted, and the sections are waterproofed. Lastly, structure backfill is placed and compacted.

Cast-in-Place (CIP) Reinforced Concrete Box Culverts

The excavation and bedding process is the same for CIP box culverts as it is for pre-cast boxes. The contractor submits shop drawings and a concrete QC plan for approval prior to the construction of formwork.

Once excavation and bedding are complete, the contractor places the formwork, rebar, and concrete for the base slab and short portions of each sidewall for the box culvert section, as specified in PUB 408 Section 1001.

Prior to concrete placement, the contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan. Keyed construction joints are placed at the top of the short sidewalls to tie into the remaining upper sections of the sidewalls. The box sidewalls are placed up to the top slab. After the sidewalls are allowed to settle, the top slab is placed.

After proper curing, forms are removed, voids are grouted, sections are waterproofed, and structure backfill is placed and compacted.

Measuring & Payment Methods

Concrete box culverts are paid as a lump sum item.

Formwork is incidental to the concrete placed in the forms.

17. SOUND BARRIERS (SEC. 1086)

This section addresses sound barriers used to reduce highway traffic noise for nearby residents. The most common type of sound barrier comprises a series of posts at specified spacing with either ground-mounted or surface-mounted panels placed between.

☐ Review  Documentation Required

BEFORE SOUND BARRIER INSTALLATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify that approved sound barrier shop drawings are obtained prior to barrier construction.	PPCC
☐ 	Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐	Consider items such as doors, fire hydrants, and lighting that may affect the construction of the sound barrier.	

DURING SOUND BARRIER INSTALLATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan and that test results are within specified limits.	eConcrete MCDocs
☐ 	Verify the caisson or footing top and bottom elevations are checked according to the shop drawings.	MCDocs PPCC
☐ 	Maintain a detailed inspection report for each caisson shaft as required by contract drawings, special provisions, and PUB 408 Section 1006. When applicable, perform and record the required testing for the subgrade/subbase used for barrier construction.	
☐ 	Confirm the tops of footings or caissons where the panels sit are constructed smooth or ground smooth per the tolerances provided in PUB 408 Section 1086.	

☐		Task	Reference
☐		Ensure the depth of projection of the posts or anchor bolts into the wall foundation is per shop drawings.	MCDocs
☐		Verify posts and panels conform to the vertical and horizontal erection tolerances outlined in PUB 408 Section 1086.	PPCC
☐		Confirm the steel posts are epoxy-coated or galvanized. Damage to the coating is repaired using approved methods.	
☐		For ground-mounted panels, ensure subbase/subgrade material is placed between posts as required.	
☐		Verify panels are transported, handled, and stored in the upright position only, never flat on their side.	
☐		Confirm all joints are light-tight to prevent direct sound transmission.	
☐		Ensure panels are placed between the posts to provide a vibration-free installation.	
☐		Verify posts and panels are placed in a truly vertical (plumb) position using a smart level.	
☐		Confirm joints are sealed with a caulking compound the same color as the panels.	
☐		Ensure an approved non-shrink grout is used under post base plates and to fill lifting insert holes.	ECMS
☐		Verify that elastomeric pads, joint seals, and backer rods are inserted as required between the panels and the posts.	MCDocs PPCC
☐		Verify if the approved anti-graffiti coating or stain is applied to the wall as detailed in the contract drawings.	MCDocs

AFTER SOUND BARRIER INSTALLATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Maintain a list of placed foundations, panels, posts, and other items to keep track of previous placements and payments.	

Material & Equipment

Wall foundations comprise reinforced concrete caissons or reinforced concrete spread footings, while wall panels consist of pre-cast reinforced concrete or timber panels. Posts may be pre-cast reinforced concrete, steel H beams, steel pipe posts, or timber. Neoprene bearing pads are used for seating panels on the foundations.

Color-matching non-shrink grout is required for holes resulting from lifting inserts and patching. An anti-graffiti compound or stain may be applied to the wall faces.

A survey transit is used to maintain the correct elevations of foundations, panels, and posts. Equipment for testing, placing, and curing concrete is required for foundation placement, and lifting equipment, including cranes, excavators, and front end loaders, is required for concrete, post, and panel placement. Bracing is used to hold the posts in the correct position during concrete placement. Welding equipment may be required for some steel applications.

Mechanical:				
Crane	Excavator	Front End Loader		
Hand Tools:				
Field Welding Equipment				
Testing/Inspection:				
Concrete Testing Equipment	Smart Level	Survey Transit		

Construction Methods

The contractor must submit a set of construction shop drawings and a concrete QC plan for approval prior to the construction of the sound barrier.

A reinforced concrete foundation of either drilled caissons or spread footings is placed to the required grade (as set by the contractor's surveyors). The contractor's PennDOT-certified concrete technician tests the concrete in accordance with the specifications and the approved concrete QC plan. The posts or post base plates are embedded into the foundation during foundation concrete placement. For structure-mounted sound barriers, the post-base plates may be incorporated into the structure.

If the panels are ground-mounted, the contractor grades the area between the posts as required to allow proper panel placement. Pre-cast panels will then be placed between the posts.

All lifting devices are removed or patched as required. If necessary, an anti-graffiti compound or stain is then applied.

Measuring & Payment Methods

Wall posts are paid as each item, while wall panels are paid in square feet.

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Anti-graffiti compounds, stains, caissons, and other construction materials are paid as specified in the special provisions and contract drawings.

18. EXPANSION DAMS (SEC. 1020 & 1026)

This section addresses the installation of a tooth expansion dam with a fabric-reinforced drain trough and a neoprene strip seal dam.

Tooth Expansion Dam with Drain Trough

A tooth expansion dam with a fabric-reinforced drain trough is used for bridge joints and is used as specified in PUB 408 Section 1020.

Neoprene Strip Seal Dam

A neoprene strip seal dam is used for bridge joints, including the necessary fabricated structural steel extrusions and sliding plates, and is used as specified in PUB 408 Section 1026.

☐ Review  Documentation Required

BEFORE EXPANSION DAMS PLACEMENT CHECKLIST

☐ 	Task	Reference
Tooth Expansion Dam with Drain Trough		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Review PUB 408 Sections 1020.	
☐	Review PUB 219M BC Standard 762M.	
☐ 	Ensure the tooth dam is temporarily supported before placement of concrete, in accordance with PUB 219M BC Standard 762M, and review release criteria to ensure the dam can move as temperatures change.	
☐ 	Review the accepted WPS for any required field welding and non-destructive weld testing requirements typically noted on shop drawings. Refer to Appendix A: Field Welding .	MCDocs PPCC
☐ 	Ensure field modifications are not allowed unless accepted by the Structure Control Unit or noted in the accepted shop drawings.	PPCC
☐ 	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC
Neoprene Strip Seal Dam		

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☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify a copy of the approved shop drawings is on file.	PPCC
☐		Verify that mix design and QC plans are approved in PPCC . Review and become familiar with the QC plan and sequence of operations.	ECMS MCDocs
☐		Review PUB 408 Sections 1026.	
☐		Review PUB 219M BC Standards 767M.	

DURING EXPANSION DAMS PLACEMENT CHECKLIST

☐		Task	Reference
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
Tooth Expansion Dam & Neoprene Strip Seal Dam			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the expansion dam has been erected in place and accordance with the shop drawings and deck placement sequence.	MCDocs PPCC
☐		Verify, in the set position, that the expansion dam matches the roadway grade and cross slope.	MCDocs
☐		Confirm the opening dimension of the expansion dam is set based on the structure temperature and that the opening dimensions for the indicated structure temperature are found in the approved shop drawings.	PPCC
☐		Ensure the epoxy bonding compound is placed on transverse blockout joints.	MCDocs
☐		Confirm temporary shipping angles have been removed and the plates ground smooth.	
Tooth Expansion Dam with Drain Trough			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

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☐		Task	Reference
☐		Ensure all areas that require welding and/or painting are completed before the drainage trough is attached to the dam (due to accessibility).	
☐		Verify that the concrete placed under the expansion dam is vibrated until the concrete is forced through the air holes in the dam.	
☐		Confirm edges of the expansion dam that are exposed to traffic or pedestrians are ground as specified.	MCDocs
☐		Ensure the ends of the drain trough are watertight.	
☐		Verify the depth of the drain troughs is set to prevent contact with the substructure per PUB 219M BC Standard 762M.	
☐		Confirm the drainage trough is installed with stainless steel fasteners per PUB 219M BC Standard 762M.	
☐		Verify there is no longitudinal or transverse splicing of the drainage trough; however, if indicated, ensure splices are vulcanized by the manufacturer.	
Neoprene Strip Seal Dam			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the seal channels are free of concrete and debris.	
☐		Verify the installed seal is not cocked or twisted per PUB 408 Section 1026.	
☐		If stretching the seal during installation is unavoidable, ensure the elongation of the seal does not exceed 5%, in accordance with PUB 408 Section 1026.	
☐		Confirm that damaged seals are removed or replaced.	
☐		Ensure seals are not spliced unless indicated, and then only those splices that are vulcanized by the manufacturer are acceptable.	
☐		Inspect expansion dam coating and, if necessary, ensure touch-up paint is completed.	
☐		Ensure utilization of lubricant adhesive and manufacturer recommendations for installation of the gland meet PUB 408 Section 1026 specifications.	
☐		Adhere to shop drawings for installation requirements.	MCDocs

☐ 	Task	Reference
		PPCC
☐	Ensure openings between rail members and box support members are covered during concrete placement.	
☐	Verify that exposed surfaces of dam armor are protected from damage during concrete placement.	
☐	Confirm that the rebar placed around the dam matches that shown on the plan drawings before concrete placement.	

AFTER EXPANSION DAMS PLACEMENT CHECKLIST

☐ 	Task	Reference
Tooth Expansion Dam & Neoprene Strip Seal Dam		
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
Tooth Expansion Dam with Drain Trough		
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure any coatings damaged during the installation of the dam are repaired per PUB 408 Section 1020.	
☐	Flood the trough with water and inspect for leaks.	

Material & Equipment

The materials required are listed on the PennDOT-approved shop drawings and in PUB 408 Sections 1020 and 1026.

The equipment used by contractors for the placement of the expansion dams will vary and may include cranes, and welders. Other equipment may be used as long as the placement is done in accordance with the shop drawings.

Mechanical:				
Chain Hoist	Come Along	Crane		
Hand Tools:				
Field Welding Equipment	Hammer	Wrench		

Testing/Inspection:				
Concrete Testing Equipment	Smart Level	String Line	Tape Measure	

Construction Methods

Tooth Expansion Dam with Drain Trough

The construction of the tooth expansion dam must be completed with strict adherence to the approved shop drawings, PUB 219M BC Standard 762M, and PUB 408 specifications.

A review of documents should be performed to determine critical items such as required opening at setting temperature, block out width, acceptable field welding, final elevations, and texturing.

If welding is required, ensure an approved welding procedure has been accepted by the District SCE. In addition, confirm welding personnel have submitted their qualifications.

The tooth dam should be assembled according to the accepted shop drawings. Temporary supports/whalers may be required and should be detailed on the accepted shop drawings. The dam installation procedure should be discussed between the contractor and the Department Representative.

Once the steel tooth dam has been set, reinforcement should be placed and confirmed against the contract plans. If phased construction, ensure couplers or splices are set per plan. Touch up any reinforcement epoxy coating damaged with an appropriate coating system. Confirm the required class of concrete and place, finish, and cure according to PUB 408 Sections 1001 and 1090.

Install any additional ancillary items such as drainage troughs, downspouts, collection boxes, etc., as per accepted shop drawings, ensuring there is access to accommodate the installation.

Neoprene Strip Seal Dam

The expansion dam rails are set in place before deck placement, with final adjustments to the exact location made later in the process. Deck rebar is placed as required. Blockouts are formed at the locations shown in the contract drawings, and deck concrete is placed up to the blockouts.

Final adjustments are made to the expansion dam, and it is then secured in place with a temporary support assembly, as shown in the joint installation scheme on PUB 219M BC Standard 767M or by other approved methods. Concrete is placed in the blockouts around the expansion dam, and after the required concrete strength is achieved, the support assembly is removed from the dam. Touch-up painting is done if necessary.

The gland is then installed, per the installation notes on PUB 219M BC Standard 767M.

Measuring & Payment Methods

The tooth expansion dam is measured and paid for in pounds or as part of the structure lump sum.

Neoprene strip seals and modular dams are measured and paid for as either a linear foot item or as part of the structure lump sum.

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The tooth expansion dam and neoprene strip seal dam are eligible for payment under stored material.

19. PREFORMED NEOPRENE COMPRESSION JOINT SEAL FOR BRIDGES (SEC. 1008)

This section addresses the installation of preformed neoprene compression joint seals in bridges in accordance with PUB 408 Section 1008.

☐ Review  Documentation Required

BEFORE PREFORMED NEOPRENE COMPRESSION JOINT SEALS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation.	
☐ 	Verify that the joint is properly located and formed.	MCDocs

DURING PREFORMED NEOPRENE COMPRESSION JOINT SEALS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation.	
☐	Ensure saw cuts are not damaging the concrete edges along the length of the joint.	
☐	Verify the lubricant adhesive is applied uniformly and timely.	
☐ 	Confirm the seal being is installed properly and it is free of twists; if stretching is required, confirm it does not exceed 5% elongation.	

AFTER PREFORMED NEOPRENE COMPRESSION JOINT SEALS CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation.	
☐	Ensure compression joint seals are waterproof, especially at the gutter line.	

Material & Equipment

The materials for this item include neoprene seals, lubricant adhesive, pre-molded expansion joint filler, and foam joint fillers. Check the materials for defects (e.g., damage to the sealers and joint fillers or frozen lubricant adhesive).

Equipment used to apply seals includes double-bladed concrete saws.

Mechanical:				
Double Blade Concrete Saw				
Testing/Inspection:				
Tape Measure				

Construction Methods

Review contract plans and PUB 219M BC Standard 766M to ensure a joint location is formed and concrete is placed as required. Some items to review are if a full joint-height ½ inch neoprene sponge and water stop are to be installed if an asphalt overlay will be placed, and how the concrete is to be finished at the proposed joint. Typically, the concrete is finished flush without tooling the edges.

Once the concrete has cured, use a double-bladed saw to perform a saw cut to the depth and width recommended by the seal's manufacturer. Water blasts the sawed joint to remove slurry from the joint immediately after sawing operations.

Remove any spalled concrete and/or foreign material before the installation of the seal. Once the groove is cleaned and dry, apply lubricant adhesive on the faces of the groove. Install the seal while the adhesive is still wet. Ensure the seal is installed continuously and is typically upturned into the barrier. Ensure the seal is depressed 1/8-inch to ¼-inch below the roadway surface.

If accessibility issues occur that limit the ability to perform saw cutting, then the joint may be formed with foam joint filler.

Measuring & Payment Methods

Payment for this item is typically made by the linear foot or as part of the structure's lump sum. These materials are usually not paid for as stored materials.

20. SCUPPERS & DOWNSPOUTING (SEC. 1051)

This section addresses the installation of scuppers and downspouts in accordance with PUB 408 Section 1051. Scuppers are drain boxes that are embedded in a concrete bridge deck to drain water from the deck to a downspout. A downspout is a pipe that conveys water from the scupper to the ground.

☐ Review  Documentation Required

BEFORE SCUPPERS & DOWNSPOUTING PLACEMENT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify material received for scuppers, pipes, fittings, support braces, and other materials required for installing scuppers and downspouts is compliant with structure drawings and shop drawings.	ECMS MCDocs PPCC

DURING SCUPPERS & DOWNSPOUTING PLACEMENT CHECKLIST

☐ 	Task	Reference
Scuppers		
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Confirm rebar is placed around the scupper according to structure plans.	MCDocs
☐	Ensure scuppers are set ½" below the final deck elevation and secured to the proper grade before deck concrete placement.	MCDocs
Downspouts		
☐ 	Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure splash blocks, where required, are of the correct shape, size, location, and type according to the structure plan and shop drawings.	MCDocs
☐	Verify discharges into storm drains, where required, and follow roadway/drainage requirements as well as structure plans.	MCDocs

AFTER SCUPPERS & DOWNSPOUTING PLACEMENT CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Scuppers

Refer to PUB 219M BC Standard 751M for descriptions of the various types of scuppers. Materials must be accompanied by certifications and be free of cracks, blemishes, or other damage that may hamper their drainage capabilities.

Downspouts

Refer to PUB 219M BC Standard 751M for descriptions of various pipes and fittings. The material used for downspouts is 8 or 10 inches of galvanized steel, fiberglass, or polyvinyl chloride (PVC) Schedule 40 pipe. The pipe should be accompanied by certification and be free of cracks, blemishes, or other damage that may hamper its drainage capability.

The equipment used to install the scuppers and downspouts includes aerial lifts and cranes.

Mechanical:				
Aerial Lift	Crane	Crane Basket		

Construction Methods

Scuppers

Scuppers are incorporated into the deck formwork before concrete placement. The rebar is placed around the scupper, as shown in the structure plans and the bridge construction standards.

The scupper is placed ½ inch below the required deck grade and secured in preparation for concrete placement. After the concrete is placed, the downspouting is connected to the scupper.

Downspouts

The downspouting is connected to the scupper on the underside of the bridge deck. It is fitted, piece by piece, and oriented according to the shop drawings/structure plans. Downspouting is often installed by hand, with the assistance of a boom lift or crane basket.

The downspout outlets to a splash block or storm drain. If splash blocks are used, they should be formed and poured using Class A concrete.

Measuring & Payment Methods

Scuppers and downspouts are measured and paid as part of the lump sum bridge item.

21. LATEX MODIFIED MORTAR OR CONCRETE WEARING SURFACE (SEC. 1042)

This section addresses the placement of a one-course-wearing latex-modified mortar (LMM) or latex-modified concrete (LMC) wearing surface.

☐ Review  Documentation Required

BEFORE LMM OR LMC WEARING SURFACE PLACEMENT CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify all equipment for the latex-wearing surface work is accepted by PennDOT before commencing work and that equipment meets the requirements outlined in PUB 408 Section 1042.	PPCC
☐ 	If hydrodemolition surface preparation is being used, ensure a water control plan has been approved, as outlined in PUB 408 Section 1039.	PPCC
☐ 	Ensure scarification of the deck surface to the depth indicated begins no more than seven days before the placement of the overlay, as specified in PUB 408 Section 1041.	
☐ 	Within 24 hours of placement, inspect all surfaces to be overlaid have been cleaned by an approved method and covered to prevent contamination.	
☐ 	Prior to placement, verify the surface to be overlaid is watered for at least one hour to ensure the deck is thoroughly saturated. Vacuum standing water and dampen visible dry spots before latex placement.	
☐ 	Confirm proportioning and mixing equipment can deliver a specified minimum quantity per hour as listed in PUB 408 Section 1042.	
☐	Verify the mixing truck has separate covered compartments for each ingredient of the LMM concrete.	
☐	Ensure the feed system on the mobile mixer truck delivers all ingredients to the mixer unit at the specified rate.	
☐	Confirm the mixing unit produces latex of uniform consistency and without segregation.	

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☐		Task	Reference
☐		Prior to latex placement, ensure each mobile mixing truck is calibrated in the presence of the inspection staff in accordance with PUB 19 PTM 637 and samples of the latex by the materials unit have been taken.	
☐		Monitor if weather conditions cause a variable moisture content change in the aggregate (e.g., rain, winds), and ensure the mobile mixer truck bins are emptied and refilled with new aggregate.	
☐		Ensure PUB 408 Section 1042 is referenced for limitations of latex operations.	

DURING LMM OR LMC WEARING SURFACE PLACEMENT CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the contractor's finishing crew consists of at least 60% certified finishers per PUB 408 Section 704.	
☐		During surface preparation, ensure all rust and corrosion on rebar is removed, all unsound concrete is removed, and necessary repairs are made to the concrete surface being overlaid.	
☐		Confirm mobile mixer trucks are recalibrated after the specified amount of latex is placed.	
☐		Ensure aggregate is used within 12 hours of being loaded into the mobile mixer.	
☐		Verify latex grout is scrubbed on surfaces to be overlaid, not prepared by hydrodemolition and vertical edges. Make sure excess aggregate from brushing is removed and discarded.	
☐		Oversee that the grout cannot dry before the overlay material is placed.	
☐		Ensure material testing, sampling frequencies, and target points are as specified in the QC plan and PUB 408 Section 1042.	PPCC
☐		Witness 12-foot straight-edge testing during placement as specified in PUB 408 Section 501.3, paying attention to lanes and shoulder breaks. Check longitudinally at the gutter line to ensure there are no low spots.	

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☐		Task	Reference
☐		Verify wet burlap water cure is applied within 15 feet of the finishing machine. Water cure for the duration listed in PUB 408 Section 1042.	
☐		Ensure membrane forming and monomolecular compounds are not used for curing and curing procedures follow specifications in PUB 408 Section 1042.	
☐		Witness the contractor's certified concrete technician performing concrete testing in accordance with the specifications and the concrete QC plan and that test results are within specified limits.	eConcrete MCDocs

AFTER LMM OR LMC WEARING SURFACE PLACEMENT CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Confirm the latex overlay is dry-cured after the water cure for the amount of time specified in PUB 408 Section 1042.	
☐		Verify mechanical texturing is not applied until five days after placement.	
☐		Ensure heavy equipment and vehicular traffic are not permitted on the latex surface until the specified time and strength have been met as specified in PUB 408 Section 1042.	
☐		Verify the hardened latex is tested with a 12-foot straight edge as specified in PUB 408 Section 501.3. Do not perform mechanical texturing until surface tolerance is checked and any necessary high points are removed.	
☐		Ensure the latex overlay has been resounded, as directed by the District SCE.	

Material & Equipment

Materials for this work include cement, fine and coarse aggregate, water, and latex emulsion admixture, all in accordance with PUB 408 Section 1042.

The placement of a latex-wearing surface involves several operation stages, each requiring specific equipment, including surface preparation equipment, proportioning and mixing equipment, and placing and finishing equipment. PUB 408 Section 1042 details the equipment requirements necessary to complete the placement.

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Mechanical:				
Deck Finishing Machine	Fogging Equipment	Hydrodemolition Machine	Latex Mobile Mixer	Work Bridge
Hand Tools:				
Broom	Brush	Concrete Bullfloat	Concrete Rake	Concrete Vibrator
Testing/Inspection:				
12-foot Straight Edge	Depth Check Gauges	Evaporation Meter	Probe Thermometer	

Construction Methods

Prior to surface preparation and latex placement, the QC plan must be approved, and all equipment must be accepted for use. Conduct a pre-latex placement meeting at least two weeks before overlay placement.

The contractor begins preparing the deck by removing a specified depth of the existing concrete deck and making necessary repairs to the concrete. This can be accomplished by scarification and/or hydrodemolition. If scarification is being performed, it shall be completed no more than seven days before placement. The contractor will perform Type 3 repairs after scarification and/or hydrodemolition and Type 2 deck repairs exceeding 4 inches. Type 2 deck repairs that do not exceed 4-inch depth can be placed concurrently with the latex overlay.

The rebar is cleaned of rust and corrosion by abrasive blasting. Epoxy repair coating is not applied to the rebar. Twenty-four hours before placement, the deck is thoroughly cleaned by water and air blasting, and the surface is covered with clean full-width polyethylene sheeting to prevent contamination. At least one hour before placement, the deck is thoroughly soaked with water. Standing water is vacuumed from the deck surface. Dry spots are dampened before latex placement.

At least seven days before latex placement, all mixing units are calibrated in the presence of the inspection staff, and the contractor's PennDOT-certified concrete technician performs any required testing. Initial testing of the latex occurs immediately before the placement begins. Slump testing for LMC differs from conventional concrete; the material is transported to a location unaffected by vibration and allowed to sit undisturbed for five minutes. After five minutes, the material is remixed, and the slump test is performed. After the placement has begun, additional air, slump, and temperature tests are taken after every five cubic yards of material placed. The placement of the latex does not stop while subsequent testing is performed. Any material that does not conform to the specifications is separated and removed from the deck.

During placement, the grout from the mixture is scrubbed into the surfaces to be overlaid with latex concrete at vertical surfaces and areas not prepared by hydrodemolition. Aggregate from the grout application is removed from the deck and discarded.

Latex concrete is placed and finished with a finishing machine, then manual texturing is completed before the latex becomes nonplastic, and curing is applied. If mechanical texturing is indicated, a five-day waiting period is required before mechanical texturing can occur. The deck is retested and resounded as directed.

Measuring & Payment Methods

This item is paid by square yards or as part of the lump sum. If prepared by hydrodemolition there is typically a variable depth item paid by cubic yards as well.

22. RAILING, HAND & RAILING, & PEDESTRIAN RAILING INSTALLATION (SEC. 1012, 1014, 1022, & 1023)

This section addresses the installation of various types of bridge railing as follows:

- Installation of Pedestrian Railings in accordance with PUB 408 Section 1012 on structures.
- Installation of Aluminum Bridge Railings in accordance with PUB 408 Section 1013 on structures.
- Installation of Steel Bridge Railings in accordance with PUB 408 Section 1014 on structures.
- Installation of Steel Bridge Hand Railing in accordance with PUB 408 Section 1022 on structures.
- Installation of Aluminum Bridge Hand Railing in accordance with PUB 408 Section 1023 on structures.

A hand railing is generally a 3½-inch-diameter steel or aluminum pipe mounted on a barrier located on the outer edge of a sidewalk on a bridge overhang. Specifications for hand railings and bridge railings are detailed in PUB 219M BC Standard 720M.

Pedestrian railings comprise a system of aluminum posts, rails, and balusters at the outer edge of the pedestrian walkway. Specifications for pedestrian railings are detailed in PUB 219M BC Standard 716M.

☐ Review

 Documentation Required

BEFORE RAILING INSTALLATION CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC
☐	Ensure aluminum railings are not flame-cut.	
☐	Verify materials used for handrails or pedestrian railings are not painted.	

DURING RAILING INSTALLATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure rail cuts are true, smooth, and free from burrs or ragged edges.	
☐		Verify re-entrant cuts are field drilled before any cutting is performed.	
☐		Ensure the diameter of steel and aluminum bridge railings at bend areas are in accordance with PUB 408 Sections 1013 and 1014 after rail tubes are bent to the radii indicated.	MCDocs
☐		Verify pedestrian railings are bent using heat in accordance with PUB 408 Section 1012.	MCDocs
☐		Confirm anchor bolts are embedded in and projected from the bridge deck per contract drawings and PUB 219M BC Standards 716M and 720M.	MCDocs
☐		Ensure an approved caulking material is applied to the rail base plate before placement to separate the railing metal from concrete or other metals.	
☐		Verify railing posts are placed normal to grade and rails are parallel to grade.	
☐		Confirm joints are installed and located per contract drawings and specifications.	MCDocs

AFTER RAILING INSTALLATION CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		After railing placement, confirm any opening between the railing metal and bridge concrete is sealed with an approved caulking material.	
☐		Verify all blemishes and scratches caused by the construction of the railing are repaired using approved methods per contract documentation.	MCDocs

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☐		Task	Reference
☐		Ensure oil, dirt, grease, and other foreign materials accumulated during construction are removed using contract-approved methods and materials.	MCDocs

Material & Equipment

Rails, bases, balusters, bolts, and other railing hardware may be made from steel or aluminum. A caulking compound is used to separate the railing metal from other metals or concrete. Cleaning agents are used to remove foreign material from the placed railing, and approved paint may be required to touch up blemishes on the rails.

Certified welding equipment may also be required for some railings.

Hand Tools:				
Field Welding Equipment				
Testing/Inspection:				
Smart Level				

Construction Methods

During deck or sidewalk concrete placement, the contractor places all embedded materials required for railing anchorage on the bridge. Caulking is applied to the railing base plates before railing placement to separate the metal from the concrete.

The contractor places railings on the embedded anchorage system as detailed in the contract plans. Blemishes, scratches, and foreign material are removed and repaired with approved methods.

Measuring & Payment Methods

Railings are paid in linear feet, measured from center to center of the end post. No deduction is made for gaps due to light pole foundations.

23. STRUCTURAL STEEL

This section addresses the erecting requirements of structural steel superstructures used to construct bridges in accordance with PUB 408 Section 1050.

☐ Review  Documentation Required

BEFORE ERECTING STRUCTURAL STEEL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Watch applicable safety harness training videos.	Construction Training Videos
☐	Verify welders' current certifications or qualifications are obtained for the job files. The certifications must be from an approved testing laboratory or qualified by the contractor, with documentation showing qualification testing performed. The welder should only perform welding type and position for which they are certified/qualified. Refer to Appendix A: Field Welding .	Certified Welder Wallet Card PPCC
☐ 	In certain cases, as outlined in PUB 408 Section 1050, ensure a state-registered PE has signed and sealed the falsework design drawings.	Construction Training Videos
☐	Confirm all requirements pertaining to anchor bolts, bearing areas, and bearing pads/pot bearings are met.	PPCC
☐	Ensure a certified welder completes any flame cutting of structural steel.	
Falsework		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐	Ensure the falsework used has an approved drawing for the design.	PPCC
☐ 	Verify an erection drawing for the falsework is submitted and approved per PUB 408 Section 1050.	
Erection		

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☐		Task	Reference
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure a PennDOT-approved erection plan is obtained per PUB 408 Section 1050 before erection.	PPCC
☐		Verify the contractor verifies the bearing elevations and span lengths relative to the contract drawings and PUB 408 Section 1050.	
☐		Confirm all erection procedures are according to approved drawings, ensuring all modifications made to the erection drawings are resubmitted for approval.	
Connections Using High-Strength Bolts			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure all fasteners are protected from dirt and moisture per PUB 408 Section 1050.	
☐		Verify a bolt tension measuring device will be available during erection and calibration per PUB 408 Section 1050.	
☐		Confirm rotational capacity testing for each bolt/nut/washer assembly is witnessed before bolt installation per PUB 408 Section 1050 and document as required by PUB 19 PTM 427.	
Shear Studs			
☐		Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the layout of the shear studs is checked relative to the contract and shop drawings.	MCDocs

DURING ERECTING STRUCTURAL STEEL CHECKLIST

☐		Task	Reference
Storing & Handling			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure material is checked promptly after delivery for damage or defects that may have occurred during transit.	

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☐		Task	Reference
☐		Verify structural members stored on the job site are kept clean and placed on skids in a manner that allows ready inspection per PUB 408 Section 1050.	
☐		Confirm structural members (e.g., beams, girders) are stored in an upright position per PUB 408 Section 1050.	
☐		Ensure members are protected from dirt, oil, acid, or water to avoid damage to shop paint or rusting of unpainted surfaces.	
☐		When storing longer members, ensure supports are placed close enough to prevent damage due to deflection per PUB 408 Section 1050.	
Falsework			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the required clearance dimensions around the falsework are verified.	MCDocs PPCC
Erection			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure member identification marks match the contract drawings and each member is placed in the correct position.	MCDocs
☐		Verify steel beams, splice connections, cross-frames, and diaphragm framing are located and constructed per the approved shop drawings.	MCDocs PPCC
☐		Confirm deck pan support angles along the top flange of the beams are not welded to the beam in tension areas of continuous span structures as defined on the approved contract and shop drawings (for steel beams only). Refer to Appendix A: Field Welding .	MCDocs PPCC
Connections Using High-Strength Bolts			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure cylindrical erection pins are used in a few bolt holes to achieve proper alignment at splices and field connections per PUB 408 Section 1050.	

☐		Task	Reference
☐		Once the alignment of two parts is made, verify at least ½ of the holes in the splices and field connections are filled with bolts and cylindrical erection pins (half bolts and half pins) before installing and tightening the remainder of the bolts. In connections carrying traffic during erection, ensure ¾ of the splice holes are filled with bolts and cylindrical erection pins in accordance with PUB 408 Section 1050.	
☐		Verify high-strength bolts are tightened by one of the methods listed in PUB 408 Section 1050 (e.g., turn-of-nut tightening, calibrated-wrench tightening, installation of alternate design bolts, direct tension indicator tightening, or another approved method).	
☐		Confirm galvanized bolts, once tightened, are not reused. Non-galvanized bolts can be reused once tightened, if approved, per PUB 408 Section 1050.	
☐		Witness the inspection of 10% of the bolts (two at a minimum) in the connection using a calibrated torque wrench. The inspector selects bolts to be inspected using PUB 19 PTM 1 and documents the test results as per PUB 19 PTM 429.	
☐		When applying the required torque to the bolt assembly, ensure the bolt head and nut are monitored for movement. If there is no movement, the connection is good. If one or more of the bolt assemblies move, the contractor applies the required torque to all bolts in the connection until movement ceases.	
Shear Studs			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the quantity, size, and location of placement for each shear stud type specified is verified.	MCDocs PPCC
☐		After shear studs are welded in place, verify the weld is checked for uniformity around the base.	
☐		Perform a sound test using a hammer to ensure a sufficient weld. A sufficient weld will give a high-pitched ring when struck with a hammer. Refer to Appendix A: Field Welding .	
☐		Under the direction of the SCE, a specified number (1%) of all shear studs are bent 15 degrees out of plumb using an eight-pound hammer. The weld around the base is then checked for cracks. Refer to Appendix A: Field Welding .	

AFTER ERECTING STRUCTURAL STEEL CHECKLIST

☐ 	Task	Reference
☐ 	Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	

Material & Equipment

Material for this work includes fabricated structural steel members, high-strength bolts, nuts, washers, and shear studs. Additional materials include those required to construct the falsework for the erection of structural steel, per the approved design and erection plans.

Common equipment used to erect structural steel includes lifting equipment (cranes, aerial lifts, or other acceptable lifting equipment), bolt tensioning meter, calibrated torque wrenches, air compressors, welding equipment, and generators.

Mechanical:				
Aerial Lift	Air Compressor	Crane	Generator	
Hand Tools:				
Field Welding Equipment				
Testing/Inspection:				
Bolt Tensioning Meter	Calibrated Torque Wrench	Tape Measure		

Construction Methods

Prior to the start of work, the contractor submits, for approval, the design and erection drawings for all falsework needed for the erection of the structural steel members as required in PUB 408 Section 1050. The contractor also submits, for approval, the erection procedures, traffic control plan, and specific equipment to be used in the erection of the structural steel. The erection plans outline the exact procedure for the structural steel erection, the location of lifting points on each structural member, specific equipment to be used, locations of equipment set up, all traffic control plans required for the structural steel erection, and any other relevant information related to the erection procedures.

As erection begins, the contractor constructs falsework according to the approved design and erection drawings and sets up traffic control, if required, for structural steel erection procedures. Equipment is set up as shown on the approved erection plans. Erection of the structural steel framing is performed in strict accordance with approved erection plans.

Prior to installing bolts, the contractor performs rotational capacity tests on each type of bolt/nut/washer assembly, as specified in PUB 408 Section 1050, in the presence of the inspection staff. All connections are made as indicated on the contract drawings. The final tightening of the connections is completed using one of the acceptable tightening methods

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outlined in PUB 408 Section 1050. Torque testing is performed on 10 percent of all bolt/nut/washer assemblies per splice, with a minimum of two bolt/nut/washer assemblies per splice being tested.

If required, shear studs are welded to the top flange of the beams as detailed on the contract and shop drawings. All falsework is removed when permitted.

Measuring & Payment Methods

Payments for structural steel are typically part of a lump sum or as a unit price item quantified in pounds.

The fabricated structural steel is eligible for payment as stored material.

24. STRUCTURAL STEEL PAINTING (SEC. 1070 & 1071)

This section addresses the spot painting of existing bridges with an approved three-coat system and the cleaning and painting of bridges using a three-coat system. The process involves abrasive blasting and paint removal, waste disposal, soluble salt/chloride remediation, and three-coat paint system application.

☐ Review

 Documentation Required

BEFORE STRUCTURAL STEEL PAINTING CHECKLIST

☐ 	Task	Reference
Painting Existing Structural Steel (Full or Zone Painting)		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Prior to the start of any work, ensure DEP has provided written acknowledgment that environmental protections comply with DEP regulations.	PPCC
☐	Verify all protective measures, such as environmental, traffic, and property, are in place as required.	MCDocs PPCC
☐ 	Confirm all the surface preparation work, including solvent cleaning, surface cleaning, blasting operations, and chloride/ferrous salt removal, is inspected according to the requirements of PUB 408 Section 1070.	
☐ 	Ensure a technical Representative from the paint manufacturer is available as required by PUB 408 Section 1070.	
☐	Ensure coatings are not applied in the field between October 31 and April 1 unless allowed in writing by the District per PUB 408 Section 1070.	
Spot Painting of Structural Steel		
☐ 	Review and complete the required BEFORE OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐ 	Prior to the start of any work, ensure DEP has provided written acknowledgment that environmental protections comply with DEP regulations.	PPCC
☐	Verify all protective measures, such as environmental, traffic, and property, are in place as required.	MCDocs

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☐		Task	Reference
			PPCC
☐		Ensure a technical Representative from the paint manufacturer is available as required by PUB 408 Section 1070.	
☐		Ensure coatings are not applied in the field between October 31 and April 1 unless allowed in writing by the District per PUB 408 Section 1070.	

DURING STRUCTURAL STEEL PAINTING CHECKLIST

☐		Task	Reference
Painting Existing Structural Steel (Full or Zone Painting)			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure the contractor performs inspections and tests before work commences and during the painting process in accordance with the approved QC plan, ensuring documentation of these inspections and tests is submitted to the Department for the project files per PUB 408 Section 1070.	PPCC
☐		Verify the paint is applied to clean, dry surfaces.	
☐		Confirm if surfaces are not painted within 10 hours of cleaning, or if the cleaned steel exhibits rust, the surface is analyzed for chloride contamination. If chloride is present, ensure the procedures outlined in PUB 408 Section 1070 for the chloride/ferrous salt removal process are followed. If chloride is not present, ensure the surface is again blasted clean and covered with primer.	
☐		Ensure the primer coat is applied after the inspector has accepted the surface preparation.	
☐		Verify the contractor mixes all coats of the three-coat system, including thinning, as specified in the product manufacturer's instructions.	PPCC
☐		Confirm coatings are applied when the temperature range for the air within the containment, paint, and metal is between 40 - 110F, as required by PUB 408 Section 1070.	
☐		Ensure coatings are not applied if the temperature is forecasted to drop below 40F before the coating reaches the required cure,	PPCC

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☐		Task	Reference
		according to the drying times specified by the manufacturer and PUB 408 Section 1070.	
☐		Verify coatings are applied when the surface temperature of the steel is at least 5F greater than the dew point and when the relative humidity is within the product manufacturer's specified range and PUB 408 Section 1070.	PPCC
☐		Ensure coatings are not applied when the air is misty, damp, or frosted steel surfaces, as specified in PUB 408 Section 1070.	
☐		Verify paint application (stripe coats, coating thickness, and continuity) is in accordance with specifications outlined in PUB 408 Section 1070.	
☐		If heating and/or dehumidification has been allowed by the SCE, verify that a plan has been accepted and is being adhered to as required by PUB 408 Section 1070.	PPCC
Spot Painting of Structural Steel			
☐		Review and complete the required DURING OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Ensure each coat is applied in a single application and is cured as required by manufacturers' data sheets before the application of the next coat.	PPCC
☐		Verify that blast-cleaned or power-tooled surfaces are approved by the inspector and covered with primer within the same day. If an area is left unpainted overnight, it is re-cleaned and approved by the inspector the following day, before applying the first coat of paint as per PUB 408 Section 1070.	
☐		Confirm the paint is applied only to clean, dry surfaces.	
☐		Verify the contractor mixes all coats of the three-coat system, including thinning, as specified in the product manufacturer's instructions.	PPCC
☐		Verify paint is mixed to a smooth, lump-free, homogeneous texture.	
☐		Ensure coatings are applied only when the temperature of the air, paint, and metal is above 40F and below 100F or as noted in the technical data sheet and PUB 408 Section 1070.	
☐		Verify coatings are applied when the surface temperature of the steel is at least 5F greater than the dew point.	

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☐		Task	Reference
☐		Confirm coatings are applied only when the relative humidity is within the product manufacturer's and specifications specified range.	PPCC
☐		Ensure coatings are not applied when the air is misty, damp, or frosted steel surfaces, as specified in PUB 408 Section 1070.	
☐		Verify paint application (stripe coats, coating thickness, and continuity) is in accordance with specifications outlined in PUB 408 Section 1070.	
☐		Ensure the contractor is notified of deficient paint areas and all repair procedures are inspected per PUB 408 Section 1070.	

AFTER STRUCTURAL STEEL PAINTING CHECKLIST

☐		Task	Reference
☐		Review and complete the required AFTER OPERATION CHECKLIST under PUB 8 Section 100.7 Project Documentation .	
☐		Verify the information stenciled on the outside face of the fascia beams at the abutment ends is accurate.	

Material & Equipment

Painting Existing Structural Steel (Full or Zone Painting)

The materials list for painting existing structural steel includes a coating system listed in PUB 35 Bulletin 15, with the following three components: prime coat, intermediate coat, and finish coat. Additional materials for the work may include abrasive blasting media, paint thinner, cleaning solvents, caulking, penetrating sealers, and clean water.

Equipment commonly used to paint existing structural steel includes blasting equipment, high lifts (e.g., lifts, cranes), scrapers, paint mixers, paint strainers, paint sprayers, rollers, brushes, air compressors, lighting, specialty inspection equipment, and containment equipment.

According to PUB 408 Section 1070, several required items must be submitted and accepted by the District before any work related to the painting can commence. The list includes the following:

- Finish coat color chips
- Coating certifications
- Manufacturer's data sheets and instructions
- DEP notification
- Soluble salt remediation plan
- QC plans
- Concrete rust removal method

In addition, a pre-paint meeting is required to take place 14 days before painting operations.

Spot Painting of Structural Steel

Materials for spot painting include a prime coat, intermediate coat, and finish coat. Additional materials for the work may include abrasive blasting media, paint thinner, caulking, penetrating sealers, and cleaning agents (if necessary).

Equipment commonly used to paint existing structural steel includes blasting equipment, high lifts (e.g., lifts, cranes), scrapers, paint mixers, paint strainers, paint sprayers, rollers, brushes, air compressors, lighting, specialty inspection equipment, and containment equipment.

According to PUB 408 Section 1070, several required items must be submitted and accepted by the District before any work related to the painting can commence. The list includes the following:

- Finish coat color chips
- Coating certifications
- Manufacturer's data sheets and instructions
- DEP notification
- Soluble salt remediation plan
- QC plans
- Concrete rust removal method

In addition, a pre-paint meeting is required to take place 14 days before painting operations.

Mechanical:				
Abrasive Blasting Machine	Abrasive Blasting Recycler	Aerial Lift	Air Compressor	Containment Equipment
Crane				
Hand Tools:				
Brush	Needle Gun	Paint Mixer	Paint Roller	Paint Sprayer
Paint Strainer	Putty Knife			
Testing/Inspection:				
Tooke Gauge				

Construction Methods

Painting Existing Structural Steel (Full or Zone)

Public/Environmental Protection: The contractor sets up protection for properties and portions of the bridge adjacent to the blasting and painting operations. The contractor also establishes protection for pedestrian, vehicular, and other traffic in proximity to the blasting and painting operations.

Environmental protection is also required. All work must comply with the Pennsylvania Fish and Boat Commission and DEP. Work cannot begin until PennDOT receives a written

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acknowledgment that the regional DEP office was contacted, is aware of the work, and agrees it complies with DEP regulations.

Submittals have been submitted and accepted, which include a Waste Handling Plan, Containment Plan, Lead Health and Safety Plan, and Environmental Compliance Plan.

Surface Preparation: The contractor performs inspections and tests in accordance with the approved QC plan before beginning surface preparation work. The contractor must document and provide a copy of the documentation as a record of the initial conditions to the Department Representative.

- **Solvent Cleaning:** Oil and grease present on bare metal are removed before blasting. If contamination is still present after blasting or occurs between coat applications, the solvent-cleaning process is repeated.
- **Surface Cleaning:** Soil, concrete spatter, drawing compounds, salts, and other foreign matter are removed with brushes, scrapers, and/or cleaning solutions and then rinsed with fresh water. Weld spatter, slag, and flux deposits must be removed, and all burrs ground smooth on newly placed steel. Pack rust and rust scale are removed with hand or power tools.
- **Blast Cleaning and Abrasives:** Steel is blasted clean to a near-white condition using clean, dry, recyclable abrasives. The use of silica sand is not permitted, and the use of non-recyclable abrasives must be approved. Abrasive media used should provide a surface profile as required by the coatings manufacturers' data sheets.
- **Chloride/Ferrous (Soluble) Salt Removal:** These procedures must be included in the approved QC plan and completed in the presence of an inspector. All flash rust resulting from the salt removal process must be removed before applying a coating to the steel surface.

Concrete substructures are cleaned using a rust removal method, which has been approved within their QC plan.

Prior to painting, abrasive residue and dust must be removed from the surface to be painted. Within ten hours after cleaning, the metal is covered with the primer coat.

Pack rust is to be removed a minimum of ¼ inches below the edge of the steel members to where the pack rust is tight when using a dull putty knife.

Hold points for surface preparation as outlined in the specification are adhered to by the contractor's QC Inspector.

Painting: The contractor makes the necessary arrangements for the paint manufacturer's technical representative to be available as required.

During the work, the contractor performs required inspections and tests as outlined in the approved QC plan. The results are documented and submitted to the Department for the project records.

Paint components are measured and mixed as directed by the product manufacturer; this includes thinning the paint. Paint is strained as specified to remove larger particles. Coatings materials should be stored as required by the manufacturer and specifications.

The contractor applies paint only when all weather conditions specified in PUB 408 Section 1070 have been met. The method of application must meet the product manufacturer's recommendations and specifications, provide a finish acceptable to the Department, and comply with all environmental restrictions. In addition, the application must conform to PUB 408 Section 1070 guidelines for application and re-coating requirements, coating thickness, and continuity.

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Paint is applied with brushes, rollers, spray equipment, or a combination that gives the desired results and is allowable by specifications. The contractor repairs any areas of paint that are determined to be defective by the Department. After the final coat has dried, the contractor stencils the required information on the outside face of the fascia beams at the abutment ends.

Ensure that steel mating surfaces are prepared and coated to provide a slip-critical connection between members unless otherwise noted. Particular attention should be given to temperature, humidity, film thickness, and cure duration at mating surfaces.

Pack rust locations should be treated with a penetrating sealer before the application of intermediate and topcoats. The primer coat should be eliminated.

The contractor must provide safe access and allow time for the inspection to be completed in all phases of the painting process.

Hold points for application as outlined in the specification are adhered to by the contractor's QC Inspector.

Spot Painting of Structural Steel

The contractor blasts clean all areas of steel to be painted to a near-white blast condition, using an acceptable abrasive material, which may include non-recyclable media. The contractor may also use the power tool cleaning method to produce a power tool cleaning to bare metal condition. The other requirements of PUB 408 Section 1070 for surface preparation and application should be adhered to, including all hold points.

Measuring & Payment Methods

Painting Existing Structural Steel (Full or Zone)

Payment for painting existing structural steel is by lump sum.

Spot Painting of Structural Steel

Measurement and payment for this work is by lump sum.

REFERENCES

AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications

Accepted Stay-in-Place Drawings – [PPCC](#)

Approved Concrete Placement Plan – [PPCC](#)

Approved Concrete Quality Control Plan – [PPCC](#)

Approved Demolition Plan – [PPCC](#)

Approved Drilled Caisson Installation Plan – [PPCC](#)

Approved Erection Drawings – [PPCC](#)

Approved Jacking Procedure – [PPCC](#)

Approved Asphalt Mix Designs – [ECMS](#)

Approved QC Plan – [PPCC](#)

Approved Shop Drawings – [PPCC](#)

Approved Shoring Plan – [PPCC](#)

Structure Foundation Report - MCDocs

[CS-5](#) Pile Hammer Data Form

[CS-1005](#) Pile Driving Log

[Form TR-50](#) Production Joint Welding Procedure Specification (D1.1-2015)

[Form TR-52](#) Production Joint Welding Procedure Specification (D1.5-2015)

[OSHA 1926.650, 651, & 652 Subpart P](#)

[OSHA 1926.651\(c\)\(2\)](#)

[PUB 2](#) Project Office Manual

- Part C, Section 10 Structures (1000)
- Appendix A, Soil and Earthwork Forms (Report on Compaction Density Non-Movement Form TR-478A)

[PUB 15M](#) Design Manual Part 4 - Structures

[PUB 19](#) Field and Laboratory Testing Manual

- PTM 1 (Probability Sampling)
- PTM 427 (Rotational Capacity Test)
- PTM 429 (High Strength Bolt Pre-Installation Verification and Installation Inspection Testing)
- PTM 637 (Calibration of Mobile Mixers Used for Latex Modified Mortar (LMM) and Latex Modified Concrete (LMC))

[PUB 35](#) Qualified Products List for Construction (Bulletin 15)

[PUB 72M](#) Roadway Construction Standards

- RC Standard 12M (Backfill at Structures)

[PUB 213](#) Temporary Traffic Control Guidelines

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[PUB 219M](#) Standards for Bridge Construction (BC)

- BC Standard 716M (Aluminum Pedestrian Railing)
- BC Standard 720M (Aluminum or Steel Bridge Hand Railing)
- BC Standard 721M (Electrical Details)
- BC Standard 732M (Permanent Metal Deck Forms)
- BC Standard 735M (Wall Construction and Expansion Joint Details)
- BC Standard 736M (Reinforcement Bar Fabrication Details)
- BC Standard 751M (Bridge Drainage Scupper Details)
- BC Standard 755M (Bearings)
- BC Standard 756M (High Load Multi-rotational Pot Bearings)
- BC Standard 757M (Steel Pile Tip Reinforcements and Splices)
- BC Standard 762M (Tooth Expansion Dam for Prestressed Concrete and Steel I-Beam Bridges)
- BC Standard 766M (Preformed Neoprene Compression Seal Joint for Approach Slabs)
- BC Standard 767M (Neoprene Strip Seal Dam for Prestressed Concrete and Steel I-Beam Bridges)
- BC Standard 772M (Prestressed Concrete Beam Bracing)
- BC Standard 775M (Miscellaneous Prestress Details)
- BC Standard 788M (Standard Typical Waterproofing and Expansion Details – Abutment Prestressed I-Beam Bridges)

[PUB 408](#) Highway Construction Specifications

- Section 110 (Payment)
- Section 205 (Borrow Excavation)
- Section 206 (Placement and Compaction of Embankment and Fill)
- Section 501 (Reinforced or Plain Cement Concrete Pavements)
- Section 503 (Protective Coating for Cement Concrete Pavement)
- Section 704 (Cement Concrete)
- Section 1001 (Cement Concrete Structures)
- Section 1002 (Reinforcement Bars)
- Section 1005 (Piles)
- Section 1006 (Drilled Caissons)
- Section 1008 (Preformed Neoprene Compression Joint Seal for Bridges)
- Section 1012 (Pedestrian Railing)
- Section 1013 (Aluminum Bridge Railing)
- Section 1014 (Steel Bridge Railing)
- Section 1017 (Pressure Mortar Pointing and Surfacing)
- Section 1018 (Removal of Existing Bridges or Culverts)
- Section 1019 (Protective Coating for Reinforced Concrete Surfaces)
- Section 1020 (Tooth Expansion Dam with Drain Trough)
- Section 1022 (Steel Bridge Hand Railing)
- Section 1023 (Aluminum Bridge Hand Railing)
- Section 1026 (Neoprene Strip Seal Dam)
- Section 1039 (Concrete Bridge Deck Surface Preparation, Hydrodemolition)
- Section 1040 (Concrete Bridge Deck Repair)
- Section 1041 (Scarification)
- Section 1042 (Latex Modified Mortar or Concrete Wearing Surface)
- Section 1045 (Protective Coatings for Concrete Surfaces)

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- Section 1050 (Epoxy Overlay)
- Section 1051 (Downspouting)
- Section 1070 (Painting Existing Structural Steel)
- Section 1080 (Prestressed Concrete Bridge Superstructure)
- Section 1085 (Precast Reinforced Concrete Box Culvert)
- Section 1086 (Sound Barriers)
- Section 1090 (Bridge Preservation and Rehabilitation)
- Section 1091 (Epoxy Injection Crack Seal)
- Section 1108 (Post-Tensioning Operations)

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APPENDIX A: FIELD WELDING

FIELD WELDING SAFETY

- **Personal Protective Equipment (PPE):** Wear proper PPE when working near field welding operations.

1. FIELD WELDING

This section addresses field welding of steel structures, formwork, piling, and other miscellaneous items.

Material & Equipment

Material:				
Welding Electrodes				
Mechanical:				
Angle Grinder	Automatic Stud Welding Machines	Drying Oven	Generator	Stick Welding Machine
Hand Tools:				
Chipping Hammer	Wire Brush			
Testing/Inspection:				
Rod Storage	Temperature Stick			

Construction Methods

General Welding Requirements

Do not field weld on any part of an existing structure, except as shown on the drawings, without prior approval of the District Bridge Engineer.

Use the shielded metal arc welding (SMAW) process (also known as stick welding) and low hydrogen electrodes that are compatible with the base metal as specified and in accordance with the accepted Welding Procedure Specification (WPS).

Create tack welds with the same type of electrode and incorporate them into the field weld. Temporary tack welding is not permitted for bolted connections.

Do not weld when surfaces to be welded are moist or exposed to rain, snow, or wind or when welders are exposed to inclement conditions that will adversely affect the quality of the work.

Remove any moisture present at the point of the weld by applying heat. Provide windbreaks for protection from the direct wind.

Do not weld or burn when the temperature is below 0F. Preheat and maintain the temperature of the metal to at least 70F when the temperature of the metal is between 0F and 32F during welding or burning.

Appendix A: Field Welding

Preheat the steel to the specified minimum temperature for a distance equal to the thickness of the part being welded but not less than 3 inches in all directions from the point of welding.

Prior to placing the weld, thoroughly clean all portions of new and existing surfaces to receive welds of all foreign matter, including paint, for a distance of 2 inches from each side of the outside lines of the weld.

Test completed welds using visual and nondestructive methods in accordance with American Association of State Highway and Transportation Officials (AASHTO)/American Welding Society (AWS) D1.5M and D1.5 2020 Bridge Welding Code Clause 8.

Ensure post-welding touch-ups occur on painted and galvanized surfaces.

All electrodes shall be purchased in thematically sealed containers or shall be dried in accordance with the manufacturer's written drying instructions. Electrodes shall be dried before use if the thematically sealed container shows evidence of damage. Immediately after opening the thematically sealed container or the removal of the electrodes from drying ovens, the electrodes shall be stored in ovens held at a temperature of at least 250F. Electrodes exposed to the atmosphere upon removal from drying or storage ovens or thematically sealed containers shall be used within four hours. Electrodes exposed to the atmosphere for less than four hours may be returned to a holding oven maintained at a minimum of 250F, and after a minimum period of four hours at that temperature, they may be reissued. Electrodes exposed to the atmosphere for four hours may be dried at 450F to 550F for a minimum of two hours. Electrodes may be redried no more than once. Wet electrodes shall not be used. Electrodes used for welding M270 Gr. 100 and A709 Gr. 100 steels shall be dried for at least one hour at temperatures between 700F and 800F before being used, whether furnished in thematically sealed containers or otherwise. Welding M270 Gr. 100 and A709 Gr. 100 have different requirements.

All welding is to be performed by a qualified welder following the appropriate welding code or an AWS-certified welder following the appropriate welding code.

Surfaces to be welded should be smooth, uniform, clean, and free of defects that would adversely affect the weld quality.

Specific Areas

Decking and Formwork:

- **Metal Bridge Deck Forms:** Length, size, and spacing indicated on the approved shop drawings. Details vary between positive and negative moment areas for continuous steel structures. Refer to PUB 408 Section 1001.3 and PUB 219M BC Standard 732M.
- **Overhang Bracket Hangers:** Do not weld to top flanges in negative moment areas of continuous steel superstructures. Refer to PUB 408 Section 1001.
- **Welded Shear Stud Connectors:** This section describes the procedure for welding shear studs in a downward direction on a flat, horizontal (0–15 degree) surface.
- Additional testing is required for studs welded to vertical or overhead surfaces. Remove any scale, rust, primer, or other deleterious matter at each shear stud location before installing. Install shear studs with automatically timed stud welding equipment. Remove arc shields or ferrules after welding. The first two studs welded at the beginning of each day or shift shall be visually examined to ensure a full 360-degree flash. After the welds on the first two studs are allowed to cool, the studs are tested by bending approximately 30 degrees from their original position, either by striking the studs on the head with a hammer or manually or mechanically bending the stud. At temperatures below 50 degrees, bending shall preferably be done by continuous, slow application of load. If a

Appendix A: Field Welding

visual inspection shows that the studs do not exhibit 360-degree flash, or if, on testing, failure occurs in the weld zone of either stud, two more studs shall be welded and tested. If either of the second two studs fails, additional welding shall be continued on separate plates until two consecutive studs are tested and found to be satisfactory before any more production studs are welded to the member.

- For production studs where a full 360-degree flash is not obtained, the contractor may repair the stud by adding the minimum required fillet weld in place of the missing flash, provided the repair weld extends a minimum of 3/8 inches beyond each end of the discontinuity being repaired. If visual inspection reveals any stud that does not show a full 360-degree flash or any stud that has been repaired by welding, such stud shall be bent to an angle of 15 degrees from its original axis and in the direction opposite the missing portion of the flash. The inspector may select a reasonable number of additional studs for testing in this manner where conditions warrant (recommend 5 to 10 percent for the bend test and sound 100% of studs). Spot prime shear stud welds and surrounding primer damaged by shear stud placement. Refer to PUB 408 Section 1105.02 and AASHTO/AWS D1.5M and D1.5 Clause 9.
- **Steel Grid Deck:** Weld as per the approved contract drawings and/or shop drawings.

Reinforcement Bars:

- **Reinforcement:** Welding of reinforcement bars is typically not permitted. Only use welded splices if indicated or if the District Bridge Engineer gives written authorization to do so. Refer to PUB 408 Section 1002 specifications.

Piles & Caissons:

- **Pile Splices:** Refer to PUB 408 Section 1005 and PUB 219M BC Standard 757M specifications.
- **Drilled Caisson Casing:** Refer to PUB 408 Section 1006 specifications.
- **Micropiles:** Refer to PUB 408 Section 1007 specifications.

Steel Bridge Superstructure:

- **Steel Bridge Superstructure:** Field welding of steel beams must be evaluated on a case-by-case basis and approved by the District Bridge Engineer from PUB 219M BC Standard 794M. Refer to PUB 408 Section 1050 for specifications.
- **Bearings:** During welding of sole plates to girders, limit the temperature of metal adjacent to neoprene and Polytetrafluoroethylene (PTFE) bearing pads to a maximum of 300F. Refer to PUB 408 Section 1050.3 specifications.

Expansion Dams:

- **Tooth Dams:** Refer to PUB 408 Section 1020 specifications.
- **Neoprene Strip Seal Dams:** Refer to PUB 408 Section 1026 specifications.

Miscellaneous:

- **Protective Fence:** Refer to PUB 408 Section 1016 specifications.
- **Bridge Hand Railing and Barrier:** Refer to PUB 408 Sections 1022, 1023, 1025, 1088, and 1089 specifications.
- **Sound Barriers:** Refer to PUB 408 Section 1086 specifications.

Documentation

Welding Procedure Specification (WPS)

The WPS is a document providing the required welding variables for a specific application. A WPS prepared in accordance with AASHTO/AWS D1.1 and D1.5 may be considered prequalified (exempt from WPS qualification testing) or may require additional testing.

The contractor must submit a weld procedure specification to the Structure Control Engineer for approval before welding is performed.

Procedure Qualification Record (PQR)

PQRs are procedures for creating and testing a series of welds that are mechanically tested to ensure compliance with applicable requirements.

A PQR is required for welding not prequalified under AASHTO/AWS D1.1 and D1.5.

Qualified Welder

A qualified welder is someone who demonstrates the ability to produce welds meeting the specified standards (e.g., AASHTO/AWS D1.1 and D1.5).

Welder qualification documents shall be presented, along with a log or document showing continuity of maintaining that qualification (i.e., welding in the process at least every six months).

Certified Welder

A certified welder is a written testament by a third party (AWS) that the individual can produce welds meeting the specified standards (e.g., AASHTO/AWS D1.1 and D1.5).

The individual shall present an AWS Certified Welder card, which can be validated on the AWS website.

REFERENCES

[AASHTO/AWS D1.1](#) Structure Welding Code

[AASHTO/AWS D1.5](#) Bridge Welding Code

- Clause 8 (Statistically Loaded Structures)
- Clause 9 (Welded Steel Bridges)

Approved Contract Drawings - MCDocs

Approved Shop Drawings – [PPCC](#)

Approved Weld Procedure Specification (WPS) – [PPCC](#)

[PUB 219M](#) Standards for Bridge Construction (BC)

- BC Standard 732M (Permanent Metal Deck Forms)
- BC Standard 757M (Steel Pile Tip Reinforcements and Splices)
- BC Standard 794M (Utility Attachment & Support Details, Prestressed Bridges)

[PUB 408](#) Highway Construction Specifications

- Section 1001 (Cement Concrete Structures)
- Section 1002 (Reinforcement Bars)
- Section 1005 (Piles)
- Section 1006 (Drilled Caissons)
- Section 1007 (Micropiles)
- Section 1016 (Protective Fence)
- Section 1020 (Tooth Expansion Dam with Drain Trough)
- Section 1022 (Steel Bridge Hand Railing)
- Section 1023 (Aluminum Bridge Hand Railing)
- Section 1025 (Modification of Existing Barrier)
- Section 1026 (Neoprene Strip Seal Dam)
- Section 1050 (Epoxy Overlay)
- Section 1086 (Sound Barriers)
- Section 1088 (PA Type 10M Bridge Barrier)
- Section 1089 (PA Bridge Barrier)
- Section 1105 (Fabricated Structure Steel and Aluminum)

Changes in setup includes: stud gun, power source, stud diameter, gun lift and plunge, total welding lead length, or changes greater than +/- 5% in current (amperage) and time.

CLAUSE 7. STUD WELDING

AASHTO/AWS D1.5M/D1.5:2008

7.6.7 Application Qualification Test Data shall include the following:

- (1) Drawings that show shapes and dimensions of studs and arc shields
- (2) A complete description of stud and base materials and a description (part number) of the arc shield
- (3) Welding position and settings (current, time)
- (4) A record which shall be made for each qualification and that record shall be available for each contract

7.7 Production Control

7.7.1 Preproduction Testing

7.7.1.1 Before production welding with a particular setup (see 7.5.4.2) and with a given size and type of stud, and at the beginning of each day's or shift's production, testing shall be performed on the first two studs that are welded. The stud technique may be developed on a piece of material similar to the production member in thickness and properties. If actual production thickness is not available, the thickness may vary plus or minus 25%. All test studs shall be welded in the same general position as required on the production member (flat, vertical, or overhead).

7.7.1.2 Instead of being welded to separate material, the test studs may be welded on the production member, except when separate plates are required by 7.7.1.5.

7.7.1.3 The test studs shall be visually examined. They shall exhibit full 360° flash.

7.7.1.4 In addition to visual examination, the test shall consist of bending the studs after they are allowed to cool, to an angle of approximately 30° from their original axes by either striking the studs on the head with a hammer or placing a pipe or other suitable hollow device over the stud and manually or mechanically bending the stud. At temperatures below 10°C [50°F], bending shall preferably be done by continuous slow application of load. For threaded studs, the torque test of Figure 7.3 shall be substituted for the bend test.

7.7.1.5 If on visual examination the test studs do not exhibit 360° flash, or if on testing, failure occurs in the weld zone of either stud, the WPS shall be corrected, and two more studs shall be welded to separate material or on the production member and tested in conformance with the provisions of 7.7.1.3 and 7.7.1.4. If either of the second two studs fails, additional welding shall be continued on separate plates until two consecutive studs are

tested and found to be satisfactory before any more production studs are welded to the member.

7.7.2 **Production Welding.** Once production welding has begun, any changes made to the welding setup (see 7.5.4.2) as determined in 7.7.1 shall require that the testing in 7.7.1.3 and 7.7.1.4 be performed prior to resuming production welding.

7.7.3 In production, studs on which a full 360° flash is not obtained may, at the option of the Contractor, be repaired by adding the minimum fillet weld as required by 7.5.5 in place of the missing flash. The repair weld shall extend at least 10 mm [3/8 in] beyond each end of the discontinuity being repaired.

7.7.4 Operator Qualification

7.7.4.1 The preproduction test required by 7.7.1, if successful, shall also serve to qualify the stud welding operator.

7.7.4.2 Before any production studs are welded by an operator not involved in the preproduction setup of 7.7.1, the first two studs welded by the operator shall be tested in conformance with 7.7.1.3 and 7.7.1.4. When two consecutively welded studs have been tested and found satisfactory, the operator may then weld production studs.

7.7.5 If an unacceptable stud has been removed from a component subjected to tensile stresses, the area from which the stud was removed shall be made smooth and flush.

7.7.5.1 Where in such areas the base metal has been pulled out in the course of stud removal, SMAW with low-hydrogen electrodes in conformance with the requirements of this code shall be used to fill the pockets, and the weld surface shall be ground flush.

7.7.5.2 In compression areas of members, if stud failures are confined to shanks or fusion zones of studs, a new stud may be welded adjacent to each unacceptable area in lieu of repair and replacement on the existing weld area (see 7.4.3). If base metal is pulled out during stud removal, the repair provisions shall be the same as for tension areas, except that when the depth of discontinuity is the lesser of 3 mm [1/8 in] or 7% of the base-metal thickness, the discontinuity may be faired by grinding in lieu of filling with weld metal.

7.7.5.3 Where a replacement stud is to be provided, the base-metal repair shall be made prior to welding the replacement stud.

Due to potential rebar interference, the testing shall be performed on a sample plate that is similar to the production piece

A separate approved WPS (on PennDOT's D1.5 WPS form), meeting the D1.5 code requirements, is required for any SMAW (stick) stud repairs

7.7.5.4 Replacement studs (other than threaded type which should be torque tested) shall be tested by bending to an angle of approximately 15° from their original axis.

7.7.5.5 The areas of components exposed to view in completed structures shall be made smooth and flush where a stud has been removed.

7.8 Inspection Requirements

7.8.1 If visual inspection reveals any stud that does not show a full 360° flash or any stud that has been repaired by welding, such stud shall be bent to an angle of approximately 15° from its original axis.

7.8.2 The method of bending shall be in conformance with 7.7.1.4. The direction of bending for studs with less than a 360° flash shall be opposite to the missing portion of the flash.

7.8.3 Threaded studs shall be torque tested. Torque testing shall be in conformance with Figure 7.3.

7.8.4 The inspector, where conditions warrant, may select a reasonable number of additional studs to be subjected to the tests described in 7.8.1.

7.8.5 The bent stud shear connectors (Type B) and other studs to be embedded in concrete (Type A) that show no sign of failure shall be acceptable for use and left in the bent position. All bending and straightening when required shall be done without heating, before completion of the production stud welding operation, except as otherwise provided in the contract.

7.8.6 If, in the judgment of the Engineer, studs welded during the progress of the work are not in conformance with code provisions, as indicated by inspection and testing, corrective action shall be required of the Contractor at the Contractor's expense. The Contractor shall make the setup changes necessary to insure that studs subsequently welded will meet code requirements.

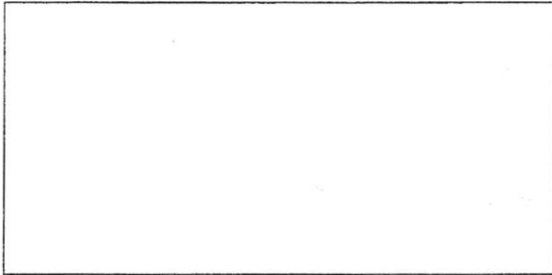
7.8.7 At the option and the expense of the Owner, the Contractor may be required, at any time, to submit studs of the types used under the contract for a qualification check in conformance with the procedures of Annex E.

STUD WELDING PROCEDURE SPECIFICATION (WPS) Yes ☐
OR PROCEDURE QUALIFICATION RECORD (PQR) Yes ☐
OR WELDER QUALIFICATION RECORD (WQR) Yes ☐

Company name _____
 Supporting PQR no.(s) _____
 Operator name _____
 Stud material _____
 Material specifications _____
 Weld base diameter _____

Test no. _____
 Revision no. _____ Date _____
 By _____
 Authorized by _____ Date _____

Stud Base Sketch/Application Detail



Base material

Specification _____
 Alloy and temper _____
 Group no. _____ Surface condition HR ☐ CR ☐
 Coating _____
 Cleaning method _____
 Decking gage _____

Shape

Flat ☐ Round ☐ Tube ☐ Angle ☐
 Thickness _____

Ferrule

Part no. _____
 Ferrule description _____

Position

Overhead _____ Downhand _____ Sidehand _____
 Angular _____ degrees from normal
 Angle iron _____ Inside radius _____ Heel of angle _____

Shielding gas

Shielding gas(es) _____
 Composition _____
 Flow rate _____

Machine data

Power supply _____
 Make _____ Model _____
 Stud gun model _____
 Weld time Secs. _____ Cycles _____
 Current _____ $\pm 5\%$ OCV _____
 Polarity _____ Lift _____
 Plunge (protrusion) _____
 Weld cable size _____ Length _____
 Number of grounds (workpiece leads) _____

WELD TEST RESULTS

Stud No.	Visual Acceptance	Option #1 Bend Test	Option #2 Tension Test	Option #3 Torque Test*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

*Note: Torque test optional for threaded fasteners only.

Mechanical tests conducted by _____ Date _____
 (Company)

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Clause 7 of AWS D1.1/D1.1M, (_____) *Structural Welding Code—Steel*.
 (year)

Signed by _____ Title _____ Date _____
 (Contractor/Applicator)

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GLOSSARY

1. ABBREVIATIONS

The following is a list of abbreviations used in this manual, publications, and standard drawings.

Abbreviation	Description
AASHTO	American Association of State Highway and Transportation Officials
ACE	Assistant Construction Engineer
ACI	American Concrete Institute
ACM	Assistant Construction Manager
ADA	Americans with Disabilities Act
ADEC	Assistant District Executive - Construction
ADED	Assistant District Executive - Design
ADEM	Assistant District Executive - Maintenance
AMG	Automated Machine Guidance
AS	Acceptance Samples
ASC	Accelerated Structural Concrete
ATPBC	Asphalt-Treated Permeable Base Course
AVR	Alleged Violation Report
AW	All-weather
AWS	American Welding Society
B&B	Balled and Burlapped
BIU	Buss Interface Unit
BMP	Best Management Practice
CIP	Cast-in-Place
CNTT	Class Non-Tracking Tack
CPMCRABC	Central Plant Mixed Cold Recycled Asphalt Base Course
CRABC	Cold Recycled Asphalt Base Course
CSL	Crosshole Sonic Logging
CTPBC	Cement Treated Permeable Base Course
CWA	Clean Water Act
CWOPA	Commonwealth of Pennsylvania
DBE	Disadvantaged Business Enterprise
DE	District Executive
DEP	Department of Environmental Protection
DGE	District Geotechnical Engineer

Glossary

Abbreviation	Description
DME	District Materials Engineer
DMM	District Materials Manager
DSP	Designated Special Provision
DWS	Detectable Warning Surface
E&S	Erosion and Sediment Control
eCAMMS	Electronic Construction and Materials Management System
ECMS	Engineering and Construction Management System
eConcrete	eConcrete
EDM	Electronic Distance Measurement
EEO	Equal Employment Opportunity
EPA	Environmental Protection Agency
ESAL	Equivalent Single-Axle Load
eTicketing	eTicketing
FHWA	Federal Highway Administration, U.S. Department of Transportation
FSB	Field Survey Book
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRS	Geosynthetic Reinforced Soil
GVW	Gross Vehicle Weight
HES	High Early Strength (Concrete)
HMA	Hot-mixed asphalt
HOLA	Hands-On Local Acceptance
IIC	Inspector-in-Charge
IRI	International Roughness Index
ITW	Inspector Training Workshop
JMF	Job-Mix Formula
LMC	Latex-Modified Concrete
LMM	Latex-Modified Mortar
LOD	Limit of Disturbance
LRFD	Load and Resistance Factor Design
LTS	Laboratory Testing Section
LWP	Light Weight Profilers
MBE	Minority Business Enterprise
MC	Mobile Construction
MCDocs	Mobile Construction Documents App
MCFA	Mobile Construction Force Account App

Glossary

Abbreviation	Description
MCMP	Mobile Construction Maintenance and Protection of Traffic App
MCPL	Mobile Construction Punch List App
MCPSA	Mobile Construction Project Site Activity App
MHL	Mileage and Hours Log
MPT	Maintenance and Protection of Traffic
MSE	Mechanically Stabilized Earth
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NECEPT	Northeast Center of Excellence for Pavement Technology
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGCS	Next-Gen Concrete Surface
NHS	National Highway System
NICET	National Institute for Certification in Engineering Technologies
NPDES	National Pollutant Discharge Elimination System
NTP	Notice to Proceed
NTT	Non-Tracking Tack
OGS	Open Graded Subbase
OSHA	Occupational Safety and Health Administration
PA	Pennsylvania
PA Guide Rail	PA Guide Rail App
PACD	Pennsylvania Association of Conservation Districts
PADEP	Pennsylvania Department of Environmental Protection
PAMS	Poly-alpha-methyl styrene
PATA	Pennsylvania Typical Application
PCSM	Post-Construction Stormwater Plan
PDA	Predetermined Amount
PE	Professional Engineer
PennDOT	Pennsylvania Department of Transportation
PG	Performance Grade
PLS	Professional Land Surveyor
PPCC	PennDOT Project Collaboration Center
PPE	Personal Protective Equipment
PQR	Procedure Qualification Record
PTFE	Polytetrafluoroethylene
PTM	Pennsylvania Test Method
PUB	Publication

Glossary

Abbreviation	Description
PUC	Public Utility Commission
PVC	Polyvinyl chloride
PWL	Percent within Limits
QA	Quality Assurance
QC	Quality Control
RAM	Recycled Asphalt Mixture
RAP	Recycled Asphalt Pavement
RC	Roadway Construction
RCE	Rock Construction Entrance
RECP	Rolled Erosion Control Products
RF	Rut Fill
RFI	Request for Information
ROW	Right-of-Way
RPS	Restricted Performance Specifications
Sample ID	Sample Identification
SCC	Self-Consolidating Concrete
SCE	Structure Control Engineer
SCM	Stormwater Control Measures
SID	Submersible Inspection Device
SIP	Stay-in-Place
SMA	Stone Matrix Asphalt
SMAW	Shielded Metal Arc Welding
SRL	Skid Resistance Level
TA	Transportation Assistant
TC	Traffic Control
TCI	Transportation Construction Inspector
TCP	Traffic Control Plan
TIF	Technically Infeasible Forms
TIP	Thermal Image Profiling
UTBWC	Ultra-Thin Bonded Wearing Course
UTCCEM	Ultra-Thin Friction Course Emulsified Membrane
VSIR	Visual Site Inspection Report
WBE	Women's Business Enterprise
WPS	Weld Procedure Specification

2. DEFINITIONS

The following is a list of words with their meanings used in this manual, publications, and standard drawings.

Word(s)	Description
Air Temperature	The measured temperature is in degrees Fahrenheit (F) in the shade, not in the sun's direct rays, and away from artificial heat.
As-Built Drawings	An assembly of original drawings with markings recording approved field changes that are not shown on the original drawings.
Asphalt Mix Design	A recipe for asphalt mixtures being used on a project. The asphalt mix design shows the grade of aggregate used, the percentage of asphalt oil, and any other additives used in the mix. The Job Mix Formula also has the density of the material on it.
Asphalt Paving Operation Quality Control Plan	Explains the contractor's plan for the placement and testing of asphalt pavement. This is based on PennDOT Form CS-401.
Asphalt Tack Coat	A mixture of asphalt oil and water is applied to an existing pavement surface to aid in adhering the newly placed asphalt mixture to the surface.
Assistant Construction Engineer (ACE)	The Assistant Construction Engineer (ACE) is responsible for overseeing and monitoring several construction projects within the District. The ACE is the immediate supervisor of the Inspector-in-Charge (IIC) and functions as a coordinator between the IIC and District units to assist in resolving issues and problems.
Assistant Construction Manager (ACM)	The Assistant Construction Manager (ACM) is responsible for overseeing and monitoring several construction projects within the District. The ACM is the immediate supervisor of the Inspector-in-Charge (IIC) and functions as a coordinator between the IIC and District units to assist in resolving issues and problems.
Assistant District Executive - Construction (ADEC)	The Assistant District Executive—Construction (ADEC) is responsible for coordinating all activities related to contract construction work in the District.
Assistant District Executive - Design (ADED)	The Assistant District Executive—Design (ADED) is responsible for coordinating all activities in the District concerning the design of highways and bridges.
Assistant District Executive - Maintenance (ADEM)	The Assistant District Executive—Maintenance (ADEM) is responsible for coordinating all activities related to accidents, traffic, roadside maintenance, municipal services, access and hauling permits, and

Glossary

Word(s)	Description
	maintenance of roadways and bridges, including snow removal in the District.
Batch Mixer Slips	Accompanies delivered concrete detailing the design and materials used for that particular batch of concrete.
Bridge	A structure, including supports, spanning and providing passage over a waterway, a railroad, a highway, or other obstruction; more than 20 feet long, measured along the center of the roadway or railroad, between the faces of abutments. In the case of boxes or arches, the length is measured between the faces of the sidewalls and, in the case of multiple boxes, between the inside faces of the outside walls.
Bridge Construction (BC) Standards (Publication 219M)	Standard drawings used for elements within bridge construction that augment the contract drawings.
Bulletins	Publications, prepared by the Department, indicating requirements for material and processes listing approved material suppliers.
Calendar Day	Every day that is shown on the standard calendar.
Clean Water Act (CWA) 404 Permit Program	A program to regulate the discharge of dredged or fill materials into waterways, including wetlands, and an approved project permit.
Concrete Mix Design	A concrete supplier's tested design for a particular concrete mix, which is approved by the Department to meet PennDOT material and strength specifications for a specific type of concrete.
Concrete Paving Quality Control Plan	A plan submitted by the contractor noting the construction methods, testing procedures, target values, and action points for the concrete roadway being constructed.
Concrete Quality Control Plan	Documentation provided by the contractor, outlining the process for producing concrete work of adequate quality. The plan includes quality control measures to be used throughout all phases of the work, including sampling, testing, and inspection.
Condemnation	The legal process used by PennDOT to acquire certain properties for Department uses.
Construction Documentation System Next Generation (CDS NeXtGen)	The computer system that is used to record activities on a project, record quantities, and enter payments for the contractor or subcontractors for work performed. The CDS NeXtGen system is part of PennDOT's ECMS.

Glossary

Word(s)	Description
Construction Plans	Approved construction documents and drawings for the project showing location, dimensions, quantities, layouts, profiles, cross sections, and other details required for construction of the project.
Contract	The written agreement between the Department and the Contractor for the construction of the project. The contract includes the following: Proposal; Plans; Specifications; Agreement; Performance Bond; Payment Bond; Insurance Certificates; Notice to Proceed; and all work orders and supplemental agreements that are required to complete the construction of the project.
Contract Drawings	Detailed drawings for the project that accommodate the contract specifications.
Contract Item (Pay Item)	A specifically described unit of work for which a price is provided in the contract. (Example: Item number 0203-0001 Class 1 Excavation)
Contractor	The individual, firm, partnership, corporation, or joint venture awarded the contract; acting directly through agents or employees, or the surety in case of default; or each participant in a joint venture.
County Conservation Districts	Districts throughout the state that administer part of the Chapter 105 Permit Program by granting certain types of permits for waterway encroachment and other erosion and sediment prevention activities.
Cross Sections	Graphic representations of the original ground and the proposed highway at right angles to the centerline or the baseline.
Culvert	Any structure, not classified as a bridge, that provides an opening under the roadway.
Delivery Tickets	Shipping invoices or bills of lading accompanying the delivered material specifying type, amount, and other pertinent information.
Demolition Plan	Documentation of the contractor's procedures for the demolition of a structure.
Department	Pennsylvania Department of Transportation; used interchangeably with "PennDOT."
District Executive (DE)	The District Executive (DE) is responsible for overseeing all work performed in the District. The work includes all functions such as the design, construction, and maintenance of highways and bridges, coordination with municipalities, the issuance of permits for access to state highways, and the design of traffic signals. The DE's responsibility also includes programming, budgeting, personnel assignments, and performance reviews.

Glossary

Word(s)	Description
District Geotechnical Engineer (DGE)	The District Geotechnical Engineer (DGE) is responsible for all work related to geology and associated engineering. They are responsible for oversight of geotechnical research and design for foundations, slopes, and other issues in the design phase. The DGE also assists with construction-related issues, such as foundations, sinkholes, slides, and unstable material.
District Materials Engineer (DME)	The District Materials Engineer (DME) is responsible for the approval and monitoring of aggregate sources, bituminous concrete plants, and Portland cement concrete plants, which include plants established on the project sites.
District Materials Manager (DMM)	The District Materials Manager (DMM) is responsible for the approval and monitoring of aggregate sources, bituminous concrete plants, and Portland cement concrete plants, which include plants established on the project sites.
Easement	A legally binding agreement between the Department and property owner allowing temporary access to private property for construction activities.
eConcrete	The eConcrete application allows PennDOT inspectors to capture, edit, save/sync, search, and retrieve concrete placement data while in the field. The inspector will enter the test result data into the app for concrete placement.
Electronic Construction and Materials Management System (eCAMMS)	The Electronic Construction and Materials Management System (eCAMMS) is a web-based system that allows users to track PennDOT's decisions on the test results, calculate test results, and report on more than 17,000 samples every year.
Engineering and Construction Management System (ECMS)	The Engineering and Construction Management System (ECMS) covers a construction project from beginning to end, including design, bid, award, management, finalization, and inspection, providing PennDOT, its business partners, and the public with up-to-date information on construction contracts and consultant agreements.
eTicketing	The eTicketing application allows inspectors and contractors to view supplier-generated material tickets and take action.
Falsework	Any temporary construction structure and/or structural elements utilized to support vertical loads and loads from wind and temperature. Falsework is utilized as temporary support for construction loads such as people, materials, and equipment, as well as the loads from the structure being constructed until the permanent structure becomes self-supporting. Temporary construction loads include, but are not limited to, plastic concrete, equipment, and placement of the concrete; any concrete that has not yet reached sufficient strength to carry the

Glossary

Word(s)	Description
	required loads; as well as steel or other structural elements under erection that are not yet in final permanent load-carrying condition. Falsework would include steel or timber beams, girders, columns, piles, foundations, and any proprietary equipment, including modular shoring frames, post shores, and horizontal shoring.
Field Survey Book (FSB)	The Field Survey Book (FSB) is used by surveyors and inspectors to record and document survey and field measurement information related to the project.
Field Test Manual (Publication 19)	PennDOT <i>Publication 19 Field and Laboratory Testing Manual</i> containing official test procedures for PennDOT projects.
Force Account Basis	Method of determining the cost of extra work not included in contract items. Hours for the workforce and equipment, as well as quantities of material, are documented in the MCFA application.
Form CS-5	Pile Log: A listing of piling depths is driven by the number of blows required to attain the recorded depth. Each piling is documented on one log sheet.
Form CS-6	Pipe Installation Inspection Form: Documentation of pipe installations under roadway, sidewalk, and shoulders, including trench backfill.
Form CS-200	Material Source of Supply: The contractor submits a listing of the material required and the intended supplier. A Department representative approves the list prior to the material being received for the project.
Form CS-206	Minimum Quality Control Plan: The contractor must submit a compaction control QC plan as outlined on Form CS-206 for review by the Department representative.
Form CS-601	Post Installation Pipe Inspection Report: Form CS-601 is the pipe inspection form to be used for documenting this type of inspection. The electronic .pdf version of Form CS-601 is form fillable and automatically calculates the allowable joint tolerance and the allowable deflection/manufacturing tolerance using information entered by the user.
Form CS-4171	Certificate of Compliance Form: Certifies that materials used on the project meet the requirements of <i>Publication 408</i> and are listed in <i>Publication 35 Bulletin 15</i> as being received from an approved source.
Form CS-6104	Plant Material Inspections Report: Used to record the results of an inspection of plant materials supplied for the project.
Form CS-4225A	Ground Rod Test Form

Glossary

Word(s)	Description
Form CS-4225B	Conductor Insulation Resistance Test Form
Form CS-4225C	Circuit Performance Test Form
Form CS-4225D	Highway Illumination Test Form
Form CS-4225E	Sign Illumination Test Form
Form CS-4225G	Conventional Lighting Poles Static Load Test Form
Form CS-4345	Borrow and/or Waste Agreement: Documents the agreement between owners of the property and the contractor for borrow and/or waste areas.
Form CS-4401	Curb Ramp Inspection: The Curb Ramp Inspection Form (Form CS-4401) will record all measurements and serve as a record that PennDOT has constructed the curb ramps to current standards or provided access to the maximum extent feasible. The form will contain the field measurements, pictures of the constructed curb ramps, and images of the Technically Infeasible Form (if applicable).
Form TR-447	Sample Identification: Used to identify materials samples sent to the Materials Testing Division for testing.
Form TR-478A	Compaction Density Non-Movement: Used to report the results of compaction testing when the visual non-movement under compaction method is used.
Form TR-4247	Method for Calculation of Moisture Density Relationship Form
Form TR-4276A	Compaction Density by Nuclear Method: used to report the results of compaction testing using a nuclear gauge.
Form TR-4276B	Optimum-Rolling Pattern for Bituminous Density Acceptance by Nuclear Method: The field inspector is to obtain a copy of Form TR-4276B and document that the compaction testing was performed according to PTM No. 402 or PTM No. 403 for each day density is accepted by the optimum rolling pattern procedure. For density acceptance by non-movement, the inspector must document visual non-movement of the material under the compaction equipment.
Formwork	Any temporary construction structure is utilized to retain and mold plastic or fluid concrete until it achieves sufficient strength to retain its shape. Formwork is vertical and used to construct walls, columns, piers, abutments, beam sides, and other vertical concrete surfaces.
Grade Line	The profile of the finished roadway surface along the proposed construction centerline or baseline.

Glossary

Word(s)	Description
Grout Mix Design	A detailed breakdown of the types and quantities of materials needed to produce a specific quantity of grout that satisfies the requirements of the specifications.
Highway	The area between right-of-way lines and/or between limits of slope lines, as ordained and/or indicated.
Hinge Point	A slope-staking term for the point where the cut or fill slope begins.
Incidental Items	Items that are not paid individually but are incorporated into the payment of another item. (Example: Formwork is incidental to concrete.)
Inspector	The person authorized and assigned by the Representative to make inspections of contract performance and material furnished.
Inspector-in-Charge (IIC)	The Inspector-in-Charge (IIC) of a project is responsible for all inspection work on the project and for providing direction and guidance to the inspectors. The IIC monitors the various contractor activities, visits field operations, reviews reports and other records, and monitors the sampling and testing of materials.
Item Quantity (IQ) Book	A book used to document measurements and calculations for the payment of contract items.
Job-Mix Formula (JMF)	A specific mixture of material established by test procedures and then adhered to during construction using the mixture.
Loose Box Samples	Samples of asphalt material taken to verify that the mix received matches the Job Mix Formula mix.
Lot	An isolated quantity of specified material from a single source or a measured amount of specified construction to be produced by the same process.
Lump Sum Item	A contract item that is paid as a single item with no quantities used for payment purposes. Structures are typically lump sum items, along with Mobilization, the Maintenance and Protection of Traffic, and the Inspector's Field office. Payments are made as a percentage of the total bid amount.
Maintenance and Protection of Traffic (MPT) Plan	Every project is prepared with a Maintenance and Protection of Traffic (MPT) Plan signed by the District Traffic Engineer and the Assistant District Executive—Construction. The MPT Plan tells the contractor when it can work on the roadway, take out lanes of traffic, detour traffic, etc.

Glossary

Word(s)	Description
Manual on Uniform Traffic Control Devices (MUTCD)	The Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets, highways, pedestrian and bicycle facilities, and site roadways open to public travel. The MUTCD is published by the Federal Highway Administration (FHWA).
Markers	Temporary locations marked with location and elevation information for use in the construction of a specific project.
Materials Testing Division (MTD)	A division of the Bureau of Construction and Materials that is responsible for testing and approving materials incorporated in projects. This includes visiting and sampling supplies included in the Bulletins of Approved Suppliers, as well as testing samples from projects for verification and final payment.
Mileage and Hours Log (MHL)	The Mileage and Hours Log (MHL) application allows consultant inspectors to create their weekly timesheets and mileage reports in the field directly from their iPads.
Milestone Date	The date on which a specific portion of physical contract work is to be completed before the Required Completion Date of all contract work.
Mobile Construction Documents (MCDocs)	The Mobile Construction Documents (MCDocs) application provides easy access through a unified gateway to construction-related documents from three disparate systems: the PennDOT SharePoint site, ECMS, and PPCC.
Mobile Construction Force Account (MCFA)	The Mobile Construction Force Account (MCFA) application allows inspectors to document labor, equipment, and material costs associated with unforeseen or additional work, ensuring accurate accounting and transparency in project expenditures.
Mobile Construction Maintenance and Protection of Traffic (MCMPT)	The Mobile Construction Maintenance and Protection of Traffic (MCMPT) app allows PennDOT inspectors to capture, edit, save/sync, search, and retrieve traffic control device data while in the field. This data will populate the related PennDOT ECMS-PSA Traffic Comment Section and Work Zone Traffic Control Compliance Checklist and Notification (CS-901) PDF.
Mobile Construction Project Site Activity (MCPSA)	The Mobile Construction Project Site Activity (PSA) application allows inspectors to create daily PSA reports while working directly in the field without a data connection.
Mobile Construction Punch List (MCPL)	The Mobile Construction Punch List (MCPL) application simplifies and enhances the process of identifying and resolving construction-related issues before project completion.

Glossary

Word(s)	Description
Monuments	Permanent locations marked with location and elevation information for use by surveyors.
PA Guide Rail	An application used for field personnel to electronically capture guide rail activities such as repairs, upgrades, installations, and removals during or shortly after completion of work and automate the updates to the Roadway Management System (RMS).
PA One Call	An entity, by law, that notifies all utilities with facilities in the construction area that construction is proceeding.
Pavement Structure	The combination of subbase, base course, and surface course that is placed on a subgrade to support the traffic load and to distribute the load to the roadbed.
PennDOT Project Collaboration Center (PPCC)	The PennDOT Project Collaboration Center (PPCC) was developed to expedite submittal requests efficiently and serve as a versatile repository for the seamless storage and retrieval of construction documentation records from any location with internet access.
Plans	The approved documents or drawings, or exact reproductions of them, for the construction of the project. The plans show the location, character, dimensions, approximate quantities, and other details of the prescribed work, including layouts, profiles, and cross sections; plans also include cited Standard Drawings. However, subsurface soil and geological data (e.g., the Soil Survey Report and Profile and Core Borings) are excluded from this definition.
Proctor Test	A test used to determine the relationship between the moisture content and density of compacted soils.
Profile Grade	The elevation or gradient of a trace of a vertical plane intersecting the proposed surface, usually along the longitudinal centerline or baseline of the roadway.
Project Drawings	Drawings showing a plan view, profile, and cross section of the roadway and/or structure being constructed. Also referred to as Contract Drawings or Plan Drawings.
Project Office Manual (POM) (Publication 2)	PennDOT <i>Publication 2 Project Office Manual</i> (POM) is a compilation of Department policies and procedures related to field administration and inspection of construction contracts. It acts as a reference for project staff so they may perform their duties in accordance with Department policies and procedures.
Project Site Activity (PSA)	A daily report used to document any work that is performed on the project, such as excavation or concrete placement. The PSA should include references to any other source document or logbook used

Glossary

Word(s)	Description
	during the work activity, including the Field Survey and Item Quantity Books.
Publication (PUB) 408	PennDOT's <i>Publication 408 Highway Construction Specifications</i> provides specifications on material, equipment, and construction methods for virtually every type of roadway and bridge project undertaken in the Commonwealth.
Quality Control (QC) Plan	A contractor's prepared plan, submitted and reviewed by the Department of the contractor's process for delivering the level of construction quality required by the contract.
Required Completion Date	The date on which all physical contract work, including any authorized additional or extra work, is to be completed. The Required Completion Date is the completion date shown in the contract plus any time extensions issued in writing by the Representative, less any time reductions issued in writing by the Representative.
Restricted Performance Specification (RPS)	A presentation of required results, statistically verifiable as meeting specified criteria and free of unnecessary construction limitations.
Right-of-Way (ROW)	The area that has been secured and reserved by the Department for highway purposes.
Roadside Development	Items for seeding, sodding, mulching, topsoiling, planting of ground covers, other planting, and items for erosion control.
Roadway Construction (RC) Standards (Publication 72M)	Standard drawings used for elements within roadway construction that augment the contract drawings.
Sample Identification (Sample ID)	The Sample Identification (Sample ID) application enables construction inspectors and materials engineers to submit requests to have their samples tested by the materials lab (Laboratory Testing Section).
Shop Drawings	Supplementary plans prepared by the contractor for manufactured components. Examples would be erection plans, cofferdam plans, falsework plans, etc.
Skid Resistance Level (SRL)	The friction rating of a surface course material.
Soil Profile	A profile that is taken longitudinally along a roadway showing the surface of the ground, the roadway grade line, and the approximate layers of soil and rock.

Glossary

Word(s)	Description
Soil Reports	Reports that describe the type, thickness, and characteristics of each layer of soil that will affect a construction project.
Special Provisions	Additions and revisions to the Standard Specifications covering conditions pertaining to an individual project and included in the Contract Documents.
Specifications	All documents referred to in or bound with the proposal that define the method and manner of work to be performed and/or quantitative or qualitative requirements for products and materials to be furnished under the contract.
Station	A precise point from which measurements are made.
Stationing	A standard system of marks established at set (measured) distances along a line.
Structure Control Engineer (SCE)	The Structure Control Engineer (SCE) is responsible for providing specialized engineering guidance and direction relating to structures.
Structure Plans	Drawings showing plan views, elevations, sections, and details of structures being constructed.
Structures	Bridges, culverts, storm sewer appurtenances, slope and retaining walls, sign support structures, and other similar items.
Subcontractor	Any individual, partnership, firm, or corporation complying with the requirements of <i>Publication 408</i> Section 102.1 who or which undertakes, with the prior consent of the Department, the partial or total construction of one or more items of project work under the terms of the contract, with and responsible to the prime contractor by virtue of an agreement.
Substructure	The part of the structure that is not deemed a superstructure.
Superintendent	The contractor's authorized representative is in charge of the work.
Superstructure	All portions of the bridge above the bridge seat, including bearings and anchors sunk in the substructure, abutment back walls, cheek walls, shear blocks, bridge drainage down to but not including the drain box, and portions of the wings and appurtenances above the horizontal construction joint nearest the bridge seat.
Supplier	A firm, company, or individual supplying material for the project.
Taking (full or partial)	The acquisition of right-of-way by purchasing either a full lot of property or a piece of property.

Glossary

Word(s)	Description
Traffic Control (TC) Standards (Publications 111, 148, and 212)	Standard drawings used for elements within construction that augment the contract drawings.
Traffic Control Plan (TCP)	A developed method or scheme for safely and efficiently moving traffic through or around a highway work zone.
Utility Adjustment	The act of placing, setting, replacing, resetting, relocating, adjusting, reconstructing, altering, or removing a utility infrastructure.
Utility Infrastructure	A public or private facility or structure, whether or not owned by a utility, that is or will be in, on, under, or over the project site or waste or borrow area designated in the proposal and that either must be placed, set, replaced, reset, relocated, adjusted, reconstructed, altered, or removed for the contract work to be performed or otherwise interferes with the performance of the contract work.
Vendor	A firm, company, or individual supplying material or services for the project.
Visual Site Inspection Report (VSIR)	The Visual Site Inspection Report (VSIR) application provides inspectors with the ability to submit mandatory routine (daily or weekly) reports for construction sites in compliance with the Environmental Protection Agency's (EPA's) mandate to ensure proper operation of any stormwater mitigation devices specified in permits issued by the EPA or state or local environmental agency.
Work	The furnishing of material, labor, equipment, and other incidentals necessary or convenient to successful project completion, plus the fulfillment of all duties and obligations imposed by the contract.
Work Order	An order, signed by the Representative, authorizing the performance of additional or extra work, or extra work on a force account basis, as specified in <i>Publication 408</i> Sections 110.02 and 110.03.
Work Zone	The area of a highway where construction, maintenance, or utility work activities are being conducted and which should have traffic control devices installed according to Title 67 of the Vehicle Code.
Working Drawings	Required shop drawings, erection plans, falsework plans, stress sheets, framework plans, cofferdam plans, bending diagrams for reinforcing steel, and any other supplementary plans or similar data, all prepared by the contractor.

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